Radiology

Handwritten Note

MBBS Help

http://mbbshelp.com

http://www.youtube.com/mbbshelp

http://www.facebook.com/mbbshelp.com

Name: _____

Subject: **Radiology**

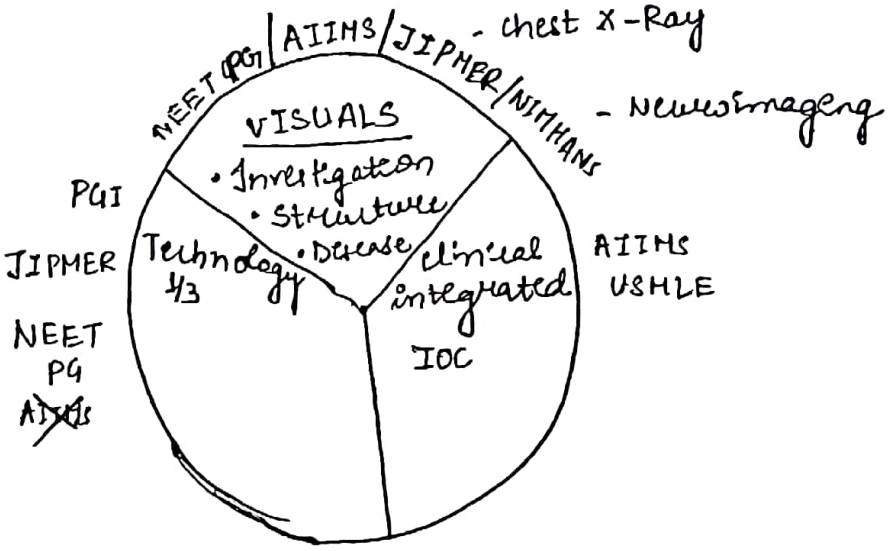
Q What kind of Radiotherapy do you use in Skull Base Chordoma

(a) x rays (c) protons.

(b) UV rays (d)

Q Kernohan notch. phenomenon is seen in? Uncal Herniation

(a)



CT SCAN

Sir Godfreey Hounsfield

1972

Novel Prize → 1979

ENGLAND

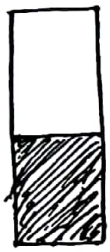
He was working for EMI (Electrical Musical Instruments)

↓ sold

they also ~~made~~ BEATLES

Computed Tomography

X-Ray



Attenuation. - ∝ x-ray stopping power of tissue.

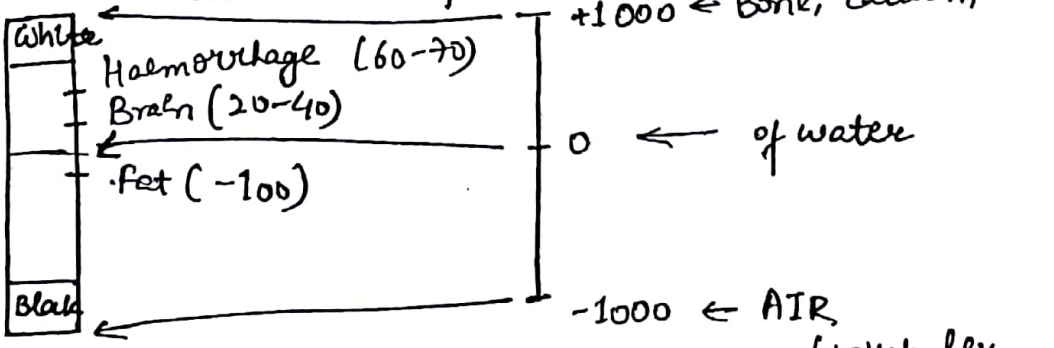
If tissue doesn't stop x-Ray

↓

Black

Computer screen has expanded grey scale.

Housefield created a scale of attenuation values of each tissue



Hounsfield Scale

Housefield value of fat = -100

more Black than H_2O

Less " " are

Brain = 20-40

Hyperdense ← white

BRAIN

Hypodense ← Dark

] For Brain CT

according to the target organ

Q. -100 HU on CT — RECALL

a) Fat b) Water

c) Brain d) Bone

Q. AIIMS child → c B/L Renal Tumour — CT Scan ⇒ -100 Hu.

What is the mode of inheritance of the disease

Angiomyolipoma → Tuberous sclerosis → AD inheritance

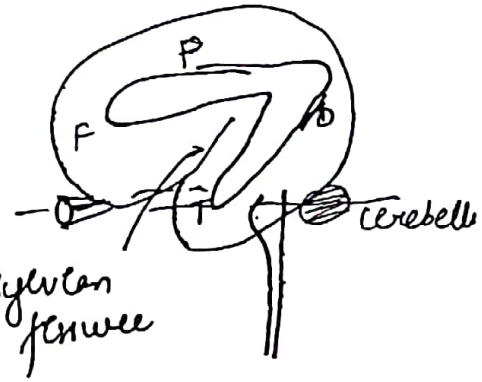
Supero-Inferior Dimension Appreciation

~~OBBS~~

1) Orbit

2) Sylvian fissure.

3) A & P Horn of Lateral ventricle



At Level of Orbit-

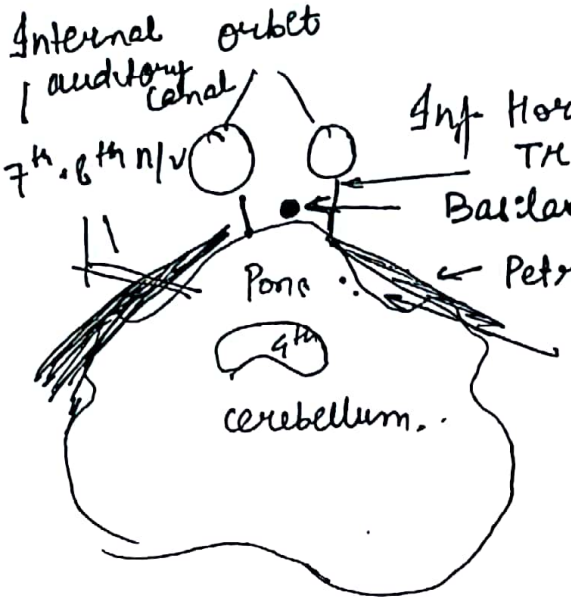
orbit → Temporal Lobe — Brainstem

Cerebellum

Lateral v. → caudate

P.No-14

3rd v → thalamus



cerebellopontene angle — cisterm
(vestibular schanoma)
↳ never midline
but Laterally

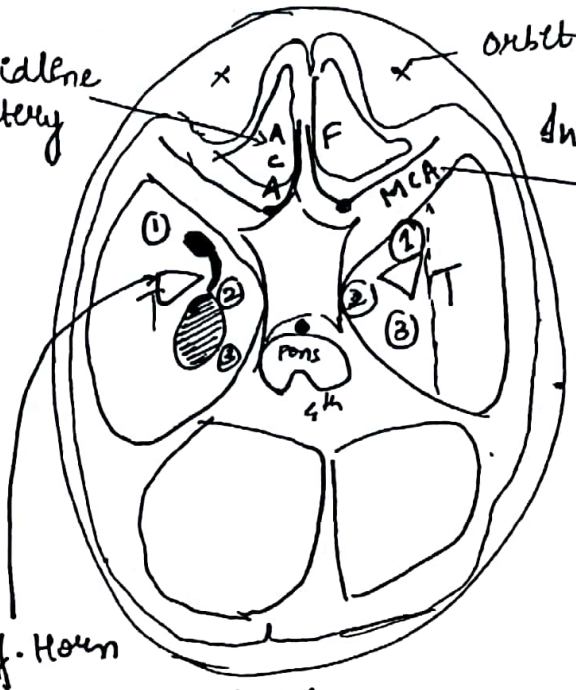
N/v arising in front of Pons towards cavernous sinus
↳ Trigeminal n/v.

⇒ ē ageing
Due to atherosclerosis of
Branch of Basilar artery
pulsating on Trigeminal n/v

⇓

Trigeminal Neuralgia

Rx → Carbamazepene



↓

Dense MCA

Earliest sign of CT. of infarct.

Inf. Horn of Lateral ventricle.

↓

In early Hydrocephalus Inf. horn is 1st part to be ballooned out.

① Amygdala
Ant to the medial (medial) Temporal Lobe.

② Uncus
Hook like structure.
Most medial.

③ Hippocampus
1st part to degenerate in. Alzeihmer's Disease

craniel pharyngioma → suprasellar cistern

↓

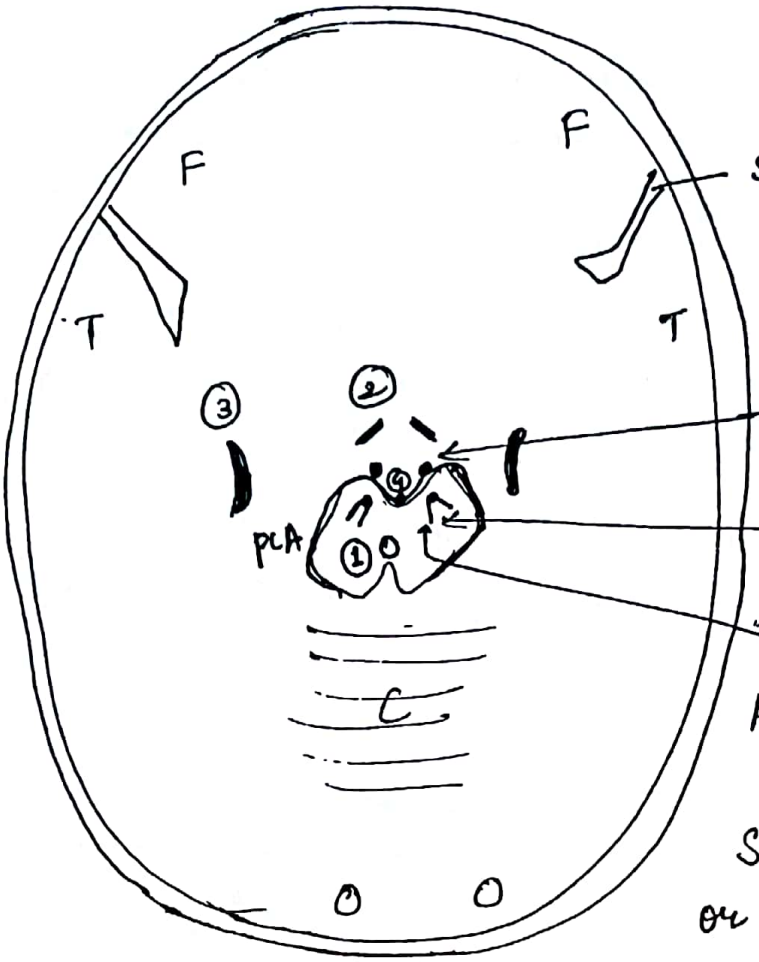
Below it pituitary is present

Infundibulum of pituitary

Pharyngeal part of Rathke's Pouch. ⇒ remnant form Tx **Craniopharyngioma**

Pituitary Development — cranial / Pharyngeal.

Above the Level of Orbit

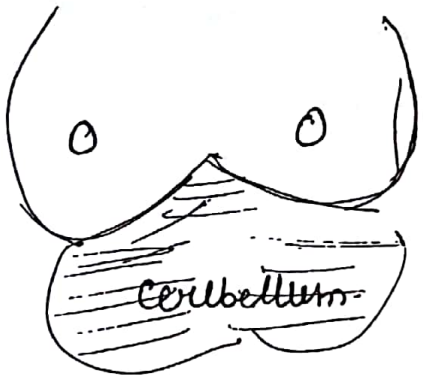


Sylvian fissure
& MCA goes to sylvian fissure

Mamillary Body — Wernicke's encephalopathy
Thymine dependent metabolism

Mid Brain.
(Heart shaped)

Substantia Nigra
Anterior part of mid brain
↓
Site for Parkinsonism or Paralysis agitans or Shaking Palsy.



① Aqueduct of sylvius.

② Optic tracts

③ Uncus
↳ Uncal Herniation
⇓
Leads to compression of mid Brain

④ Basilar artery
In interpeduncular fossa → it devides to form Post. cerebral artery & terminates here
Uncal Herniation may compress this → leading to ~~bleeding~~ blindness

UNCAL HERNIATION

Uncul Herniation this side

Tentorium

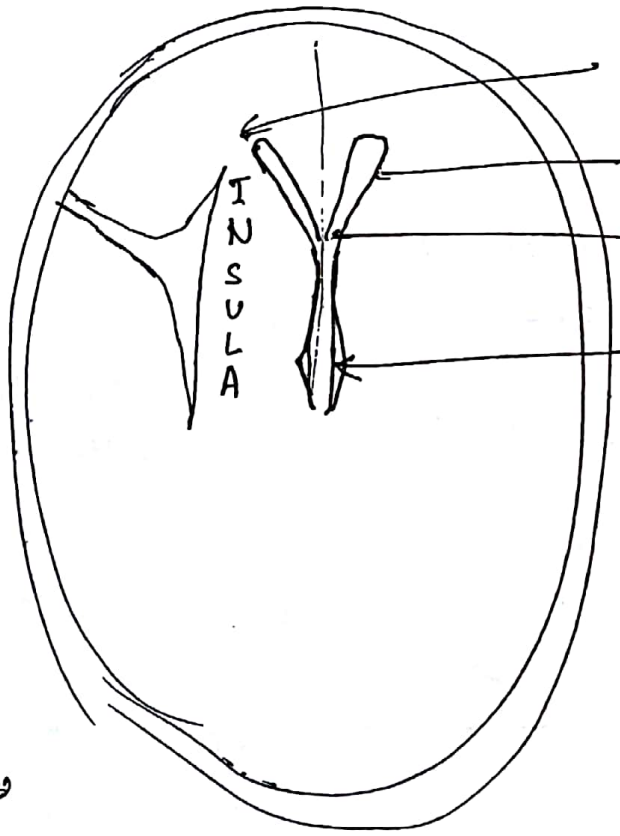
Kernohan's notch.

↓

tnt opposite to the side of Lesion (uncal Herniation)

FALSE LOCALISING SIGN

Weakness tnt on. ipsilateral side

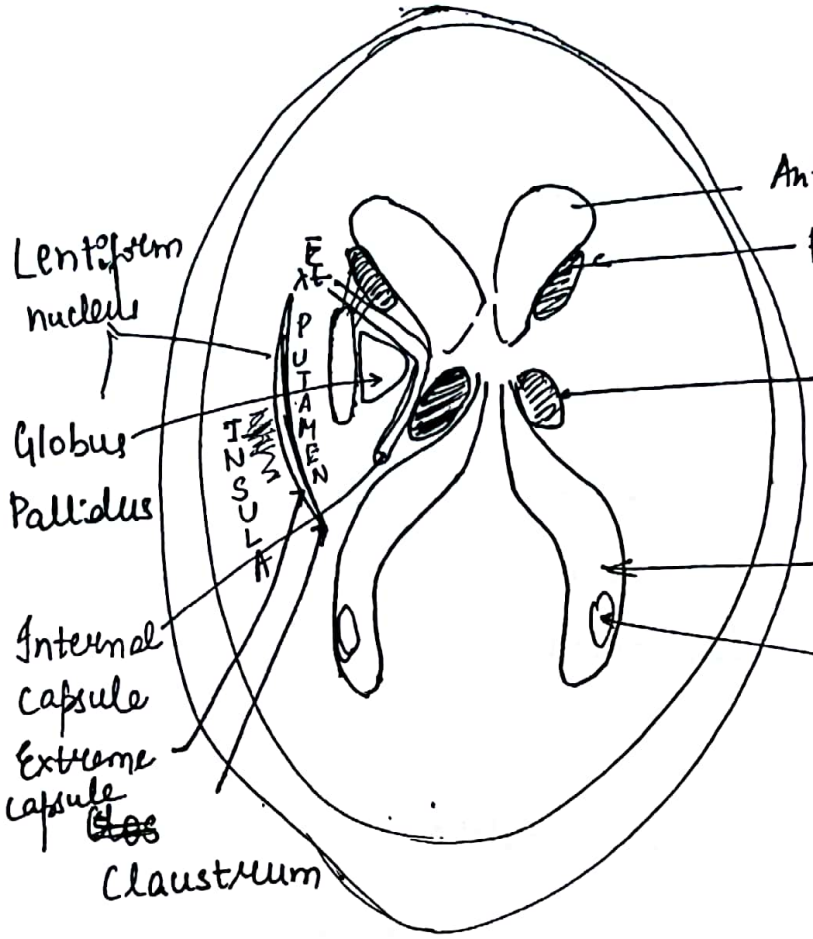


deep to sylvian fenure

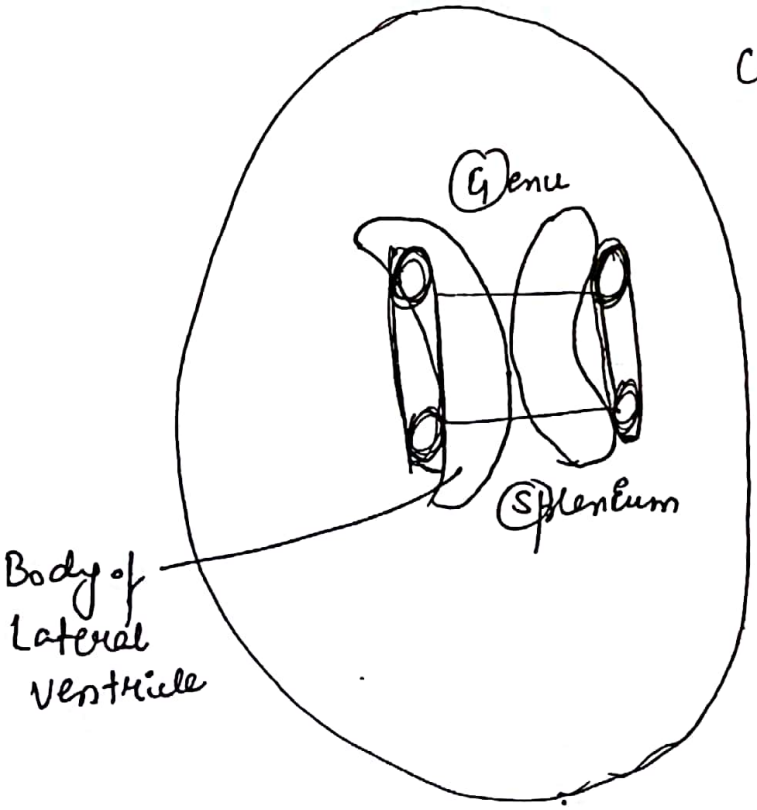
ant Horn of Lateral ventricle

Foramen of Monro

3rd ventricle



Putamen is **M/c Site** for HTN haemorrhage in Brain.



Corpus callosum separates the Lateral ventricles.

↓

In case of Agenesis of corpus callosum

↓

Parallel Lat. ventricle

"RACING CAR APPEARANCE

(Small Body + Big wheel)

SAH

Endovascular ~~clipping~~ coiling → by radiologist

↓

If coiling can't be done

↓

endovascular clipping by neuro s.x

VENOUS THROMBOSIS

Venous Thrombosis is found in Hypercoagulable state

↓

1) ♀

2) Nephrotic syndrome

Sup. Sagittal sinus Thrombosis

↓

cause B/L venous infarcts.

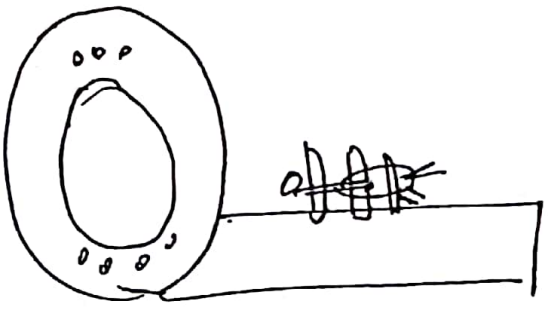
Venous infarcts are red infarcts. (Haemorrhagic)

arterial " are ~~white~~ pale infarcts.

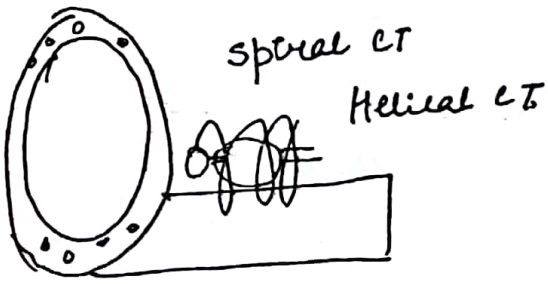
Internal cerebral vein thrombosis

↳ infarct of thalamus. (red infarct)

Sup. sagittal sinus is midline posteriorly placed



discontinuous data



continuous data

SLIP RINGS

CT Scan only can Axial (Transverse) Sections.

* Cardiac CT → done for coronary calcium scoring
"AGATSON's SCORE"

used for screening of atherosclerosis

~ 130 - cut off atherosclerosis

~ 400 - SEVERE

IOC for: Anomalous coronary origin.

ALCAPA - anomalous (L) coronary artery Pulmonary artery

⇓

MI in childhood

IOC: cardiac CT.

PYI
June 2015

Ionising Radiations:-

(1) α.
(2) β
(3) v
(4) x-ray
(5) IR
(6) light
(7) Sound

α - RAYS

→ made up of Helium nuclei He_4^{+2} – 2 protons → Heavy
2 neutrons → charged

→ LEAST PENETRATION
→ Maximum ionisation potential
→ ,, Biological Damage

β - RAYS

- made up of electron particles
- used in systemic radiotherapy

Iodine → thyroid.
phosphorus → Bone

γ - RAYS

High Energy High frequency electromagnetic waves "intranuclear".
Max. PENETRATION.

Tc 99M
Low energy
⇓
used in diagnosis

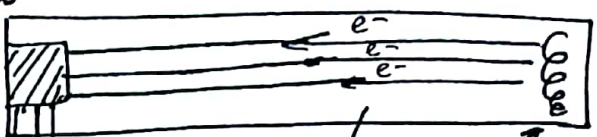
Co 60
High Energy
⇓
used in therapy

X - RAYS

High Energy, High frequency electromagnetic waves
" EXTRANUCLEAR " in origin
Not produced by Radioactive Decay

velocity of X-rays = 3×10^8 m/s

Wavelength of diagnostic x-rays. 0.1 to 1 Å.



Addison's effect
electron emitted through
Cathode

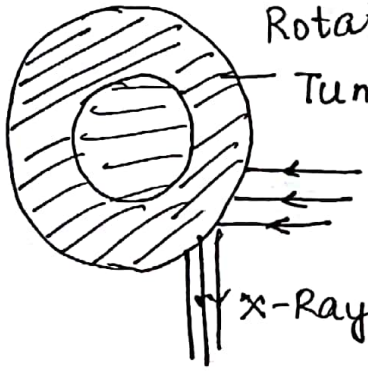
melting pt. = >3000°

* X-Rays are produced when rapidly moving electrons are halted. → kinetic energy is converted to X-Ray

BREHMSTRLANG X-Ray

↓

means ~~breaking~~ - BRAKING



Rotating anode.

Tungsten + 10% Rhenium.

X-Rays [continuous spectrum of energy].

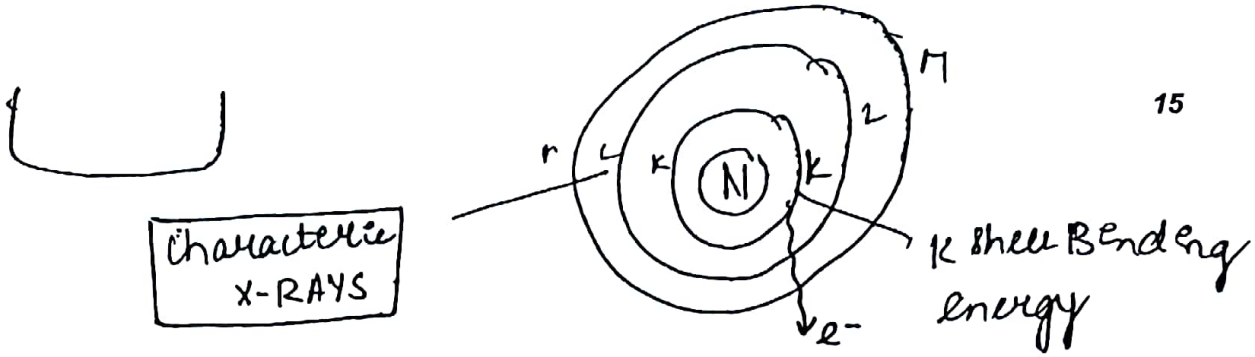
Mech. of heat loss in modern X-Ray = RADIATION.

R → Rotating anode
Rhenium
Radiation.

10^{-10} m = 1 Å

↓

diameter of atom.



Characteric X-RAYS

Low energy X-Rays → no imaging

Intermediate → cause ejection of electron from K

↓

e⁻ from L shell to K shell

↓

Energy released

[characteric X-Rays]

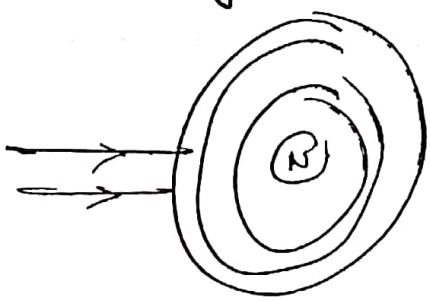
Photoelectric effect [occuring on K shell]

Leading to formation of characteristic image on film.

↓

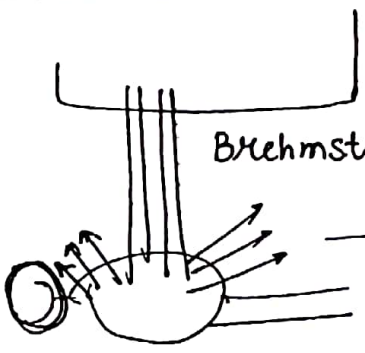
Image formed is Latent Image

High Energy X-rays —



Random scattering of electrons from outer shell due to high energy X-Rays

COMPTON EFFECT



→ these lead to exposure

Thickness of Pb apron = 0.5mm thick

Badge on chest - TLD Badge

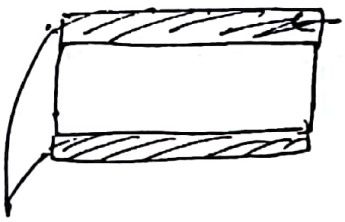
↓ for Radiation Dose Monitoring

Thermoluminescient Dosimetry

check every 3 months

Max. permissible dose of radiation for occupational diseases.

20 msV / Annum.



Photosensitive emulsion

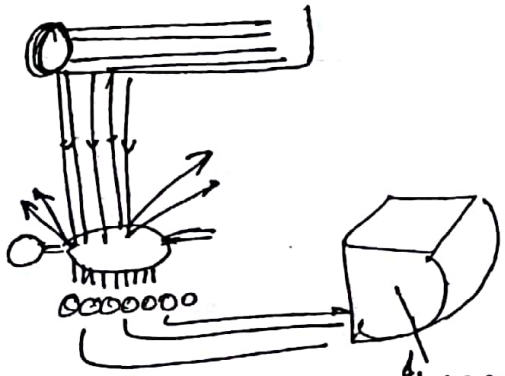
↳ AgBr + Iodide

Double Coated film.

Most sensitive to → Blue Light

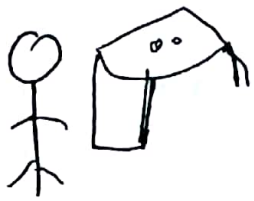
Least " " → Red Light

In Dark room, safe Light = Red Colour



Digital

Image can be processed → post



KVP

Kilovolt Peak

K = contrast

V = voltage

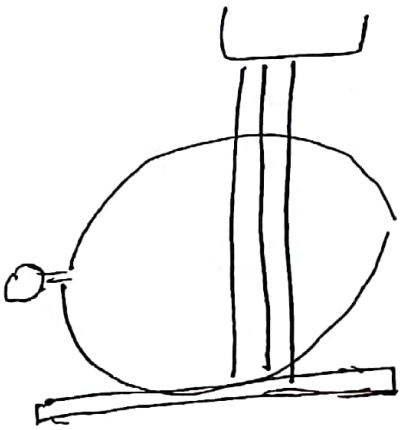
P = Penetrating power

MAS

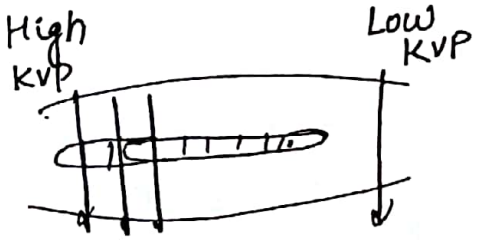
Miliampere second

Blackening seen in the ~~melk~~ film.

Radiation Dose received by patient



Obese → KVP have to be ↑

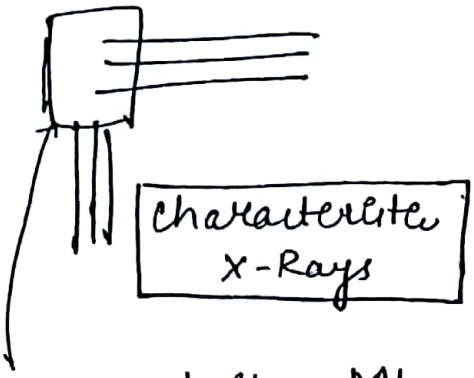


Contrast $\alpha \frac{1}{KVP}$

Penetration α KVP

Mammography

~~Made~~ → Target is made up of Molybednum.



When e^- strike Mb → they enter Mb

↓

release of e^- from inner shell → characteristic rays

Low voltage

Routine mammography → CC [craniocaudal]
MLO [Mediolateral oblique]

Single Most Imp. X-Ray in Breast
= MLO

Mammography films = Single coated

Radiation exposure in mammography = More than CXR.

~~ROOT~~

Routine Screening for Ductal carcinoma in situ
= Mammography

ACR = 40 yrs - annual mammogram

American Cancer Society = 45 yrs (Better)

IOC for High Risk Screening DCIS ⇒ MRI

MRI → DCIS = microcalcification ⇒ False

↳ Ductal enhancement.

↓

Also seen in Perimenstrual ♀ - Physiology.

↳ False ⊕

Breast MRI ⇒ Done in 2nd Week.

Most sensitive Inv for DCIS ⇒ MRI

IOC for Breast Implant → MRI evaluating

IOC for Breast Abscess → USG.

IOC for Scar vs recurrence - MRI.

IOC for Solid vs cystic - USG

IOC → Lump young ♀ = USG

USG has poor sensitivity for DCIS.

capsule formed → Implant

If Both ruptured

↓

Implant would go in Breast parenchyma

↓

Inflammation

↓

♀ presents ⊕ inflamed Breast

Intracapsular Implant rupture in USG.

↓

STEP LADDER PATTERN

↳ step ladder pattern in abd → Small Bowel Obstruction.

BIRADS

Breast Imaging Reporting & Data system.

↳ By american college of Radiology

PIRADS → Prostate

TIRADS → Thyroid.

LIRADS → Liver

BIRADS	0	Inadequate for opinion. Advise - USG. Mammography	
BIRADS	1	Normal	Continue routine screening.
BIRADS	2	Benign	
BIRADS	3	probably Benign. ↓ Short term 6 month follow up	< 2% chance of malignancy
BIRADS	4	Suspicious of malignancy	

a = low

b = intermediate

c = high

BIRADS 5 s/o malignancy } > 95%

BIRADS 6 K/c/o Biopsy proven malignancy

BIRADS –

a) mammo

b) USG

c) ~~MRI~~ MRI

d) all of above

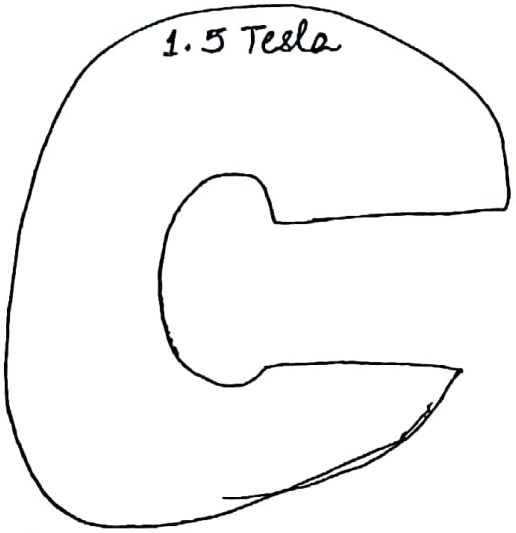
Q ♀ multiple Breast Lesions –
one – benign.
other – malignant

BIRADS –?
↳ Single impression based on most malignant lesion.

BIRADS used in (MRI) different from mammography.
↓
Each Breast given separate BIRADS

MRI

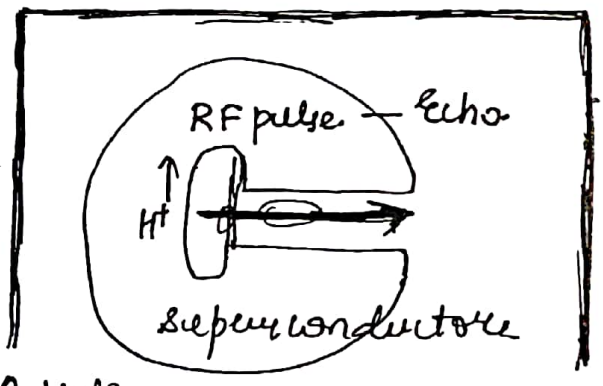
Q. MRI magnet is switched off in bet" study ?-
↳ False. ↓ always on.



Mg. field strength = 1.5 Tesla
" " " of Earth
= 50 mT.

In 3T MRI ⇒ twice Mg field
⇒ Better Image Quality

7 Tesla & 0.5 Tesla are also in research..



MRI room setting :-
copper meshwork
⊖ FARADAY'S CAGE

⊖ Helium Liquid

H^+ protons → "DIPOLE"

H^+ ions get alligned in our body according to Magnetic field

RF pulse when introduced — H^+ ion will go towards RF pulse

When RF pulse switched off → H^+ comes back to its normal position.

Spin lattice Relaxation Time-

↳ Time required by H+ to return to (N) position

T_1

Spin lattice relaxation Time

T_2

Spin spin relaxation time

T_1-WI → Based on spin-lattice relaxation time

T_2 WI → Based on spin-spin relaxation time

T_E Echo time — short — T_E = Long

T_R Repetition Time — short — T_R = Long

Relative C/I

↳ Claustrophobic

MRI- safe in ♀,

	T_1 WI	T_2 WI
① CSF	Dark	White
	Hypointense	Hyperintense
② FAT	White	Less white

Equally Hyperintense on ③

③ Cortical Bone Ca^{2+}	Dark	Dark
④ AIR	Dark	Dark
⑤ Tendon Ligament Meniscus	Dark	Dark
⑥ Hemosiderin.	Dark	Dark
⑦ Flowing Blood	Dark	Dark. Flow void. ⑧

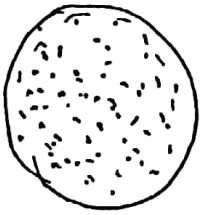
⑧ if loss of flow void → Thrombosis

⑧ Calcification & Hemosiderin.

~~not~~ ~~visualised~~ in MRI.
can't be differentiated

↓

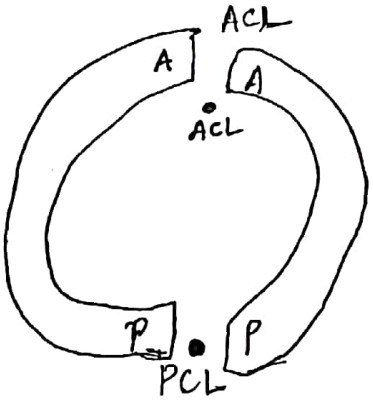
To differentiate them
Susceptibility weighted Imaging (SWI)



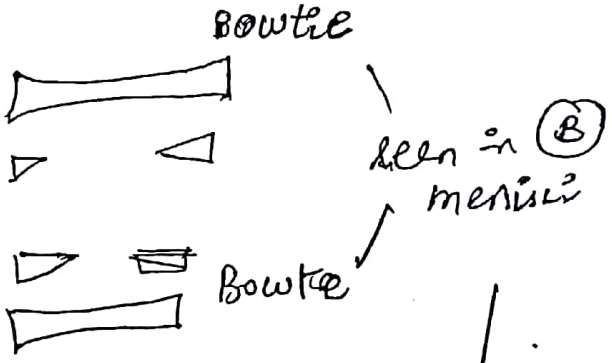
salt & pepper appearance on MRI ⇒ GLOMUS TUMOUR.

↑
Vascularity.

	T_1 WI	T_2 WI	FLAIR
CSF	Dark	white.	Dark (free water)
Oedema	Dark	white (preferred in Brain pathology)	white ★
Melanoma (Melanin) (Magnete)	white	Dark	



When A & P Horn are same
↳ Lateral Bow Tie



absence of Bow Tie
= Meniscal Tear.

Cartilage is seen on HRI.

ACL → from intercondyle to Ant. Tibia.

Cinema Hall Pain-
due to Chondromalacia patella
↓
seen- Behind the patella → patellar cartilage softening up.

PATELLA ALTA :-

Patella Higher than the (N) position

PATELLA - BAJA :-

Patella Lower than the (N) position

STIR MRI → for Bone oedema.

↳ Short Tall Inversion Recovery

	T_1 WI	T_2 WI	STIR
Marrow →	White	White	Dark
oedema →	Dark	White	White

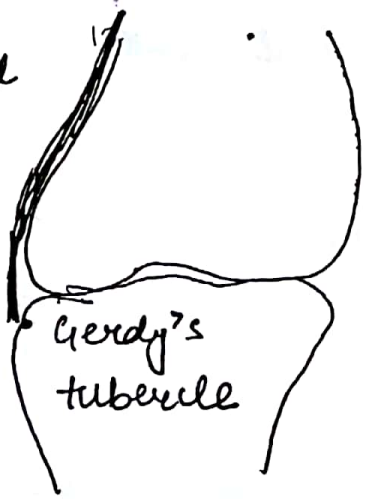
Suppress the signal of marrow fat

Injury to medio-collateral Ligament ⇒ conservative Management

More commonly injured

Degenerated tendon of adductor Magnus

Iliotibial Tract



Bankart's Lesion
↳ Seen in antero-inf. glenoid labrum.

Hillsach's Lesion
↳ seen in postero lateral Humerus

Reverse Hillsach → antero-medial
In post-Dislocation

Hatchet Defect → In. Ankylosing Spondylitis

Supraglenoid labrum ⊕ → related to Long Head of Biceps.

1st Inv to be done in rotator cuff tear = USG
IOC for rotator cuff tear = MRI
Gold Std " " " = Arthroscopy

CT
Ac. Head Injury
Ac. Brain H'ge
Calcification
IOC

Neurological
↳ MRI

Cortex of Bone → Seen better in CT Scan
So, for # → CT,
for Marrow → MRI.

Stress # → may or may not be cortical #
So, Better seen in MRI

B/L multiple stress # → Bone Scan

IOC for Acute OM ⇒ MRI.

Intraosseous Bone Tumours ⇒ MRI

AVN ⇒ MRI

Q. Chronic alcoholic taking Italian Red wine developed necrosis of corpus callosum. ∴ Syndrome?

"MARCHIFAVA BIGNAMI"

LIPOMA in Brain? Yes

↓

only congenital

M/c Site of Lipoma in Brain = **Pericallosal**

( ) → Bracket shaped calcification

M/c Pineal Gland Tx = Germinoma

Pinealoblastoma → associated ∵ Retinoblastoma

Pineal is located in post. part of 3rd ventricle

↓

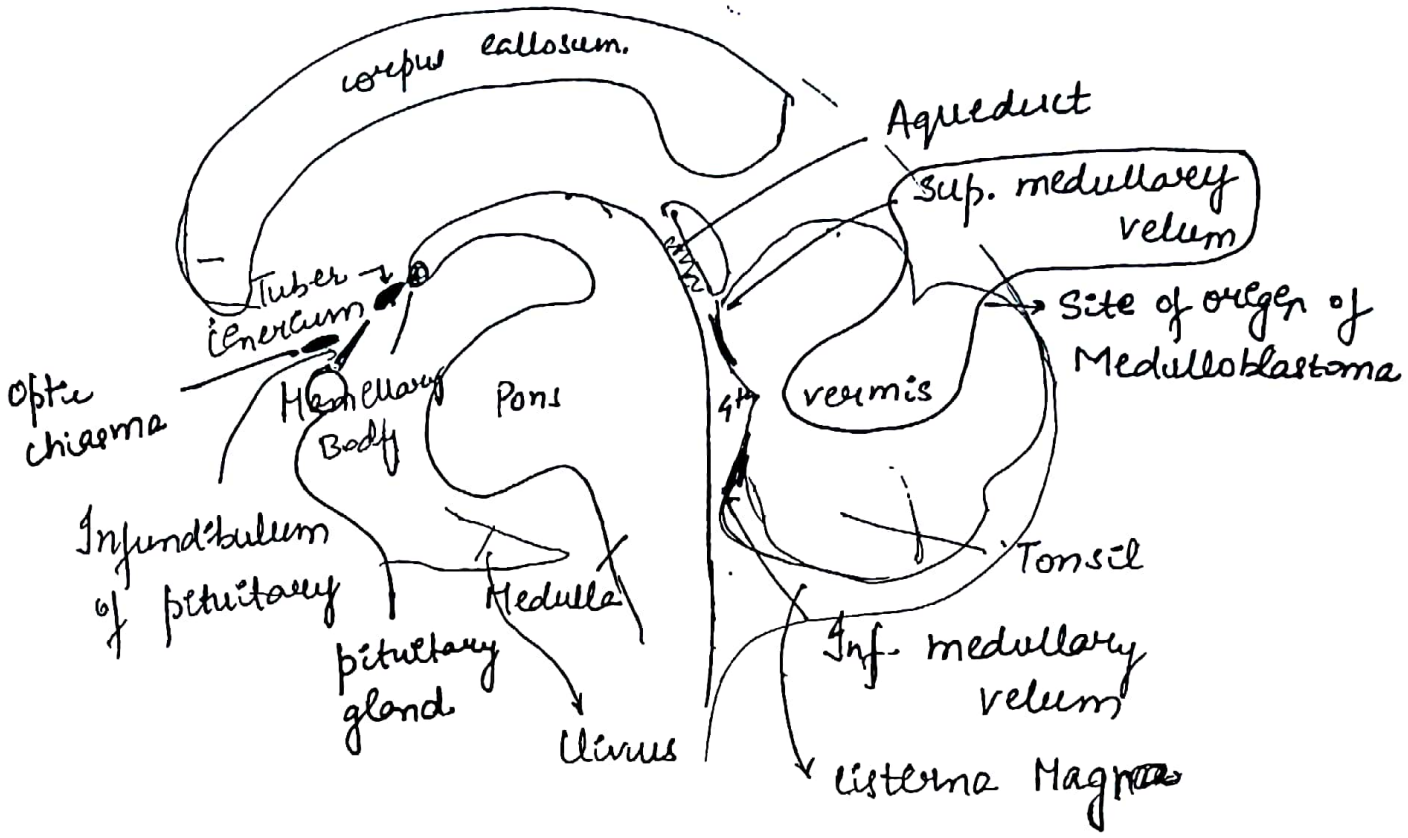
Compress Sup. colliculus ∴ is required for vertical gaze

↓

So, in pineal enlarge, compress Sup. colliculus

↓

PERINAUD Sx (upward Gaze Palsy)



Tuber cinereum

↳ ant to mamillary Body

↓

Hypothalamic Hamartoma → ① Present ⊼ Precocious Puberty

② Gelastic seizure.

↳ Bouts of Laughter.

On MRI

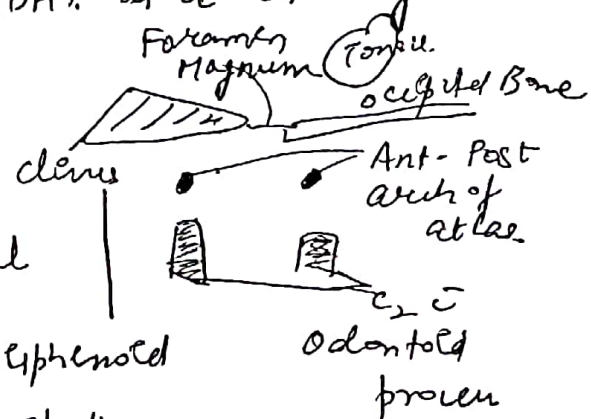
( ) ↳ white spot

pituitary gland ↳ Post-Pituitary

↳ appears white due to vasopressin (ADH). as it has magnetic properties.

CV Jun" (Cranio Vertebral)

Clivus + Vertebra + occipital



Btw basisphenoid & basiocciput

Tonsil is above the level of foramen magnum

* Small Posterioure Fossa

Tonsil goes below foramen magnum
↓
Tonsillar Herniaton.

Chiari - I Malformaton.
+
Spina Bifida / myelomenengocele

Arnold chiari malformaton
Chiari - II Malformaton

Q. Y ? When chiari I malformaton will present to hospital ?

ans 2nd Decade → SYRINGOMYELIA

↓

CAUSES

Tx | Trauma | TB.

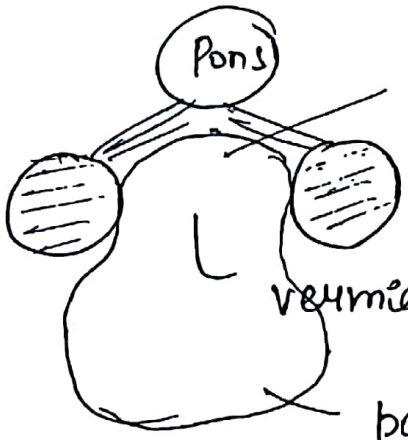
Arnold chiari malformaton.

↳ LEMON SIGN } in antenatal USG
BANANA SIGN }

TECTAL BEAKING →

LUSCHKANDEL SKULL → learner skull

DANDY WALKER



4th ventricle freely communicate ⊂ CSF filled space behind cerebellum

vermian agenesis

post. fossa cyst

♀ presents. quadriparesis.

CONG. C-V Junc" Ab(N)

* Rheumatoid arthritis → inflammation of synovium in C_1-C_2 region.

↓

Distance Bet" atlas & axis ↑

[atlanto-axial Dislocation].

↓

pressing on spinal cord

* Upward migration of odontoid process into foramen magnum → BASILAR INVAGINATION

* DOWN'S SYNDROME

CV Junc" abnormalities (+)

So, before Operating → X-Ray Neck is imp. in Down's syndrome

↓

to look for CV Junc" Abnormalities

MORQUI Syndrome
Mucopolysaccharidosis
↓ Jun" ab (N) (+)

OSTEO-MALACIA
Softening of Skull Base

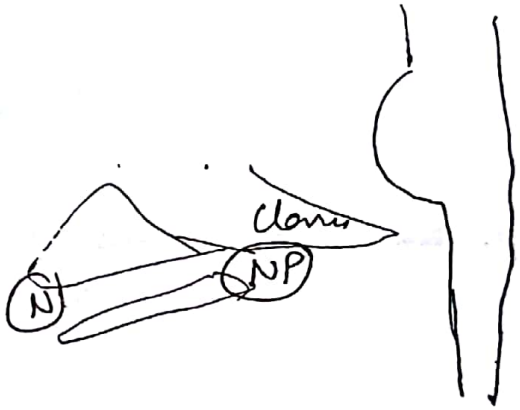
Osteogenesis Imperfecta

Paget's Disease

Clivus [Skull Base Ab (N)]

CHORDOMA

① Remnant of notochord may form Tx
② M/C → Sacrococcygeal area
③ also seen in clivus
④ Physalliferous cells
↳ cell of notochord

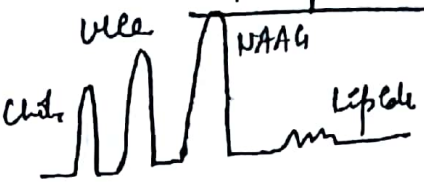


Radiotherapy

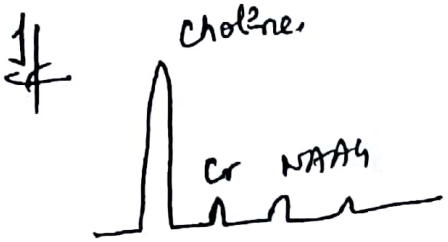
Congenital Midline Cyst / Thornwaldt Cyst
↓
Pharyngeal endoderm comes & to join notochord

MR Spectroscopy

(N)



(I)

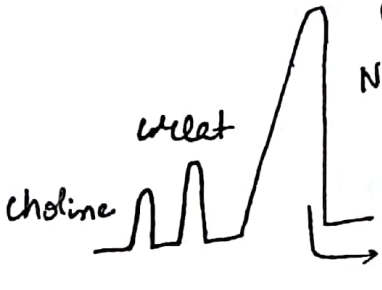


choline ↑ → ↑ cell membrane ⇒ Malignancy

Creatinine ↓ → metabolism ↑

NAAG → glioma as no neuron tht

(II)



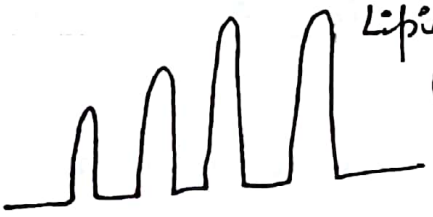
→ elevated levels of NAAG

NAAG is metabolised by Asparatocyclase

So ↑ NAAG → ⊖ of asparatoacylase

. CANAVAN'S Sx

(III)



Lipid ↑ ⇒ TUBERCULOMA.

↳ necrosis

Alanine Peak on HR spectroscopy ⇒ MENINGIOMA

DW- MRI

Based on Brownian ~~Imaging~~ Moton →

Ischaemia → ATP ↓ → Na^+/K^+ ATPase stop working

↓

neuron swelling

(cytotoxic oedema)

↓

Endothelial cells damage

↓

Vasogenic oedema ← on routine CT/MRI

appears on 6-24 hrs

3-30 min. of onset → ↓ by DW-MRI.

use of thrombolysis can be done

Functional MRI

MRCP

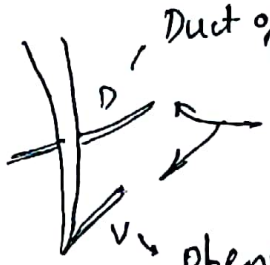
IOC for choledochal cyst → MRCP.

Chain of ~~them~~ Lake appearance → on chr. Pancreatitis

Linear filling Defect in Bile Duct = Worm

↓

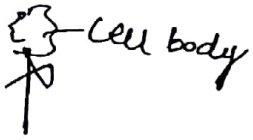
Biliary Ascariasis



- Minor papilla is ~~small~~ narrow, so there is not much space for drainage
  ↓
  presents ~~chronic~~ recurrent Pancreatitis

Diffusion Tensor Imaging

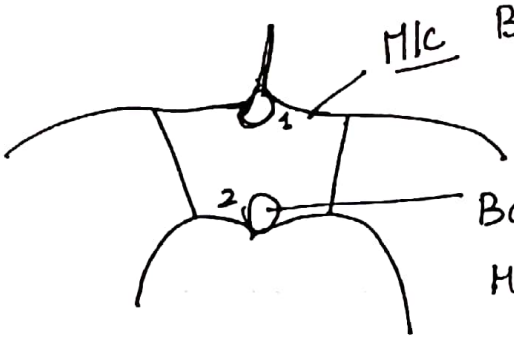
Pt. underwent RTA 1 month back, since then he is comatose → CT scan looks (N)



↳ Diffuse Axonal Injury

M/c site → Grey-white Junction

By Diffusion Tensor Imaging → can be Δ



MR angiography is used to screen cerebral ~~angiography~~ aneurysm

IOC for cerebral aneurysm → CT scan.

ADPCKD → have more chance of Berry aneurysm
MR angiography for screening

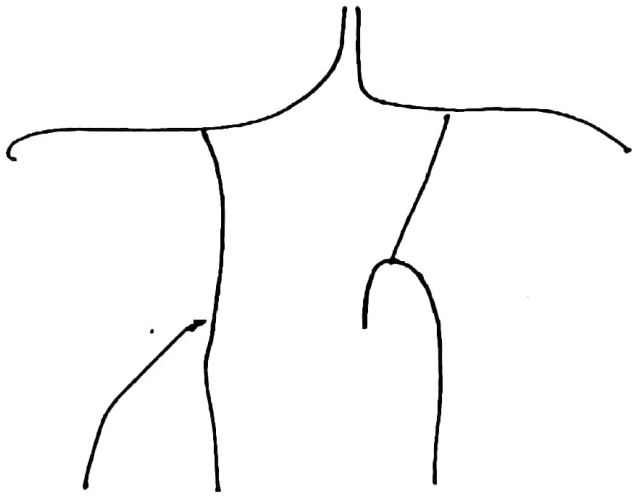
Single ACA → Azygous ACA

↓

If thrombosis occurs

↓

B/L infarction [B/L infarct seen in venous thrombosis]



Fetal PCA

↓

Blood supply from Int carotid artery

Thalamus derives blood supply from PCA

In case of fetal PCA

↓

If thrombosis occurs

↓

B/L thalamus infarct.

Artery of Percheron → D/D

Internal venous infarct.

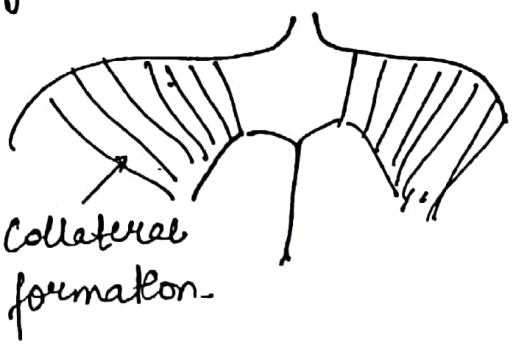
Recurrent artery of Heubner
↓ ↳ Branch of Ant cerebral artery
commonly injured by Sx while clipping ~~Ant~~ Ant. cerebral artery aneurysm.

area supplied by recurrent artery of Heubner

Q Pt develops ~~supraglenoid~~ supraclinoid ICA stenose.
Idiopathic + progressive
↓
collateral formation occurs gradually

MOYA-MOYA DISEASE.

Puff of smoke appearance



MR Venography

* **Veen of Galen malformation**

Congenital AV fistula in mid Brain.

↓

Veen of Galen dilated

↓

Hydrocephalus

↓

High output Cardiac failure

IOC = MR Venography

Dye

CT Scan ⇒ Iodinated contrast

↳ radio-opaque

~~H/c + Soft tissue F*~~

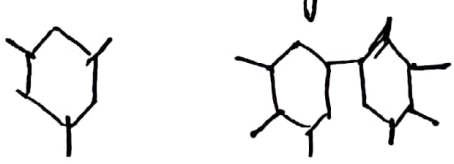
Most radio-~~opaque~~ dense soft tissue of Body

= THYROID

Iodinated contrast

- Ionic
  - Monomer
  - Dimer
- Non-Ionic
  - Monomer
  - Dimer

Depending on Benzene Ring ← Monomer / Dimer



Iodine : Particle ratio ⇒ 3:2 (Monomers) 1400-6600 mosm

" " ⇒ 6:1 (Dimers) 600-800 mosm.

not used nowadays due to ↑ osmolality → Anticoagulant Property (Desirable)

Monomer

Urografin, Gastrografin → Diatrizoate

Conray → Iothalmate

Dimer

Ioxaglate

Used for long angiographic procedure (Low osmolality + anticoagulants)

Non-Ionic

Monomer

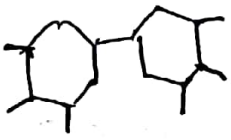
Iodine : Particle ratio

3:1

eg

- Iohexol
- Ioversol
- Iopamidol

Dimer



Iodine : Particle ratio

6:1

300 mosm (isosmolar)

- Iodixanol
- Iotralan

Idiosyncratic

Direct ↑ Histamine release

Anaphylactoid Rxn.

Non - IgE

Adrenaline - life saving

Test Dose prediction → No

Tubulointerstitial Injury

Non-allergic Nephropathy

Transient

Contrast Nephropathy ↑ ,

Rise in S. creatinine at least 0.5mg or 25% baseline measured after 48 hrs.

Prevention → Hydration

use non-ionic dye

[N-acetyl cystein] ~~drugs~~
[Sod. bicarbonate]

Preserve Trial

2018 → No role of N. acetyl cystein & Sod. Bicarbonate.

GODOLINIUM -

used in MRI

Lanthanide

Para - Magnetic substance → Unpaired electron in outer shell ⊕

Reduces T_1

CE MR → ~~①~~ T_1 wt . ② T_2 wt ③ FLAIR

It is used as chelated form → Gd-DTPA

Gadolinium in itself is toxic substance.

Crosses placental Barrier →

Teratogenic

↓

Should be "avoided in ♀."

Gd-DTPA

↓

Renal Excretion.

If eGFR. < 30 mL/min in CRF

↓

Gd accumulate

↓

Painful, multisystem febrotic

FATAL

↓

Nephrogenic Systemic Fibrosis

In case of renal failure → plain MRI., CT.

Gd-DTPA → doesn't cross BBB

If there is inflammation in Brain or aggressive neoplasm.

↓

they take up dye

Determinant of enhancement in Brain → BBB

* other tissues → vascularity

CXR

28/3/18

True or False

1) CXR-(PA) view is mandatory in RTA ⇒ FALSE.

↓

CXR-AP view - True

2) AP-CXR.

a) Erect

b) Supine

c) Both.

AP & PA views are according to rays.

Lateral & Oblique views are according to films kept

(R) side → Rt lateral

By default if side not mentioned ⇒ Left Lateral

Steeple Sign on Neck X-Ray = CROUP

Measure the Dist Bet" spinous procen and medial end of clavicle · should be equidistant

↓

If not, called ROTATION

Rotaton of on CXR –

a) Asymmetry in lung lucency & can be mistaken as pathology

b) Asymmetry – HILAR

c) Apparent cardiomegaly

Apparent cardiomegaly in CXR is due to

1) supine view
2) expiration view
3) Rotation

* Hilum = Bif. of Pulmonary artery + upper lobe vein

↓

L.N.
Tx
Dilatation of P. artery

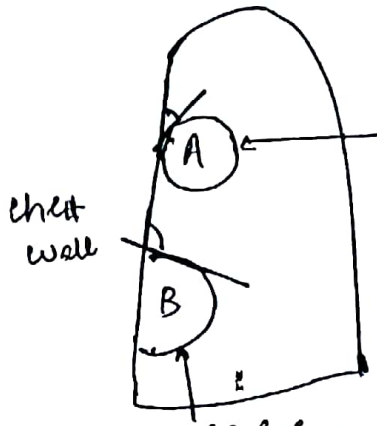
If L.N. +nt → Hilum will not be concave
It will be convex.

Bronchovascular markings are usually not in. Medial 2/3rd of Lung

Plethora = ↑ BVM
= > medial 2/3rd of Lung

Air Bronchogram seen in Pneumonia

Fluid Detected By X Ray =	100 - 200 mL (150 mL)



[obtuse ∠ ē chest wall]

Vanishing Lung :- BULLA.

~~Visceral pleura~~ not ~~coast~~ contour not parallel to chest wall.

Vanishing Pleura Line Sign Absent

* RTA ē Blunt ~~Ad~~ Abd. Trauma → 1st STEP evaluation

FAST → focused Assesment ē Sonography in Trauma

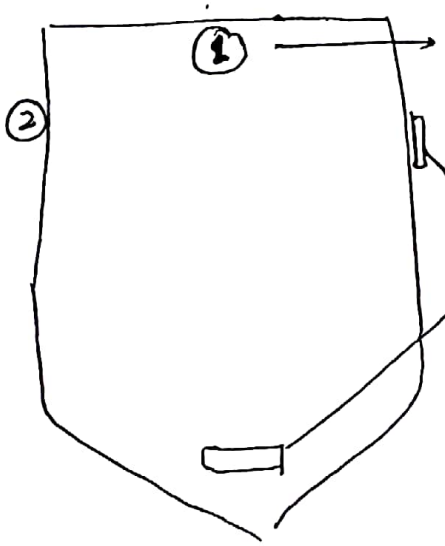
⇓

→ Done By ER. Physician.

→ Take under 5 min.

→ Hemoperitoneum.

↳ How much Blood can be detected by FAST
>200 mL (50-250 mL)



1st - epigastrium - For cardiac Tamponade

2nd → Ⓡ flank = for morrison's pouch.

3rd → Ⓛ flank = for splenic Blood

4th → - for Pelvic collect

ℓ FAST = extended FAST
for thoracic evaluation.

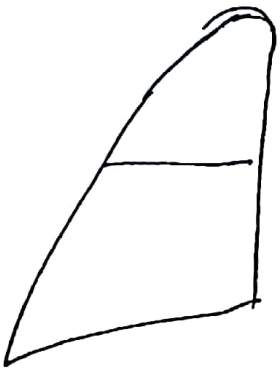
Hemothorax ← → Pneumothorax

IOC for Blunt Abd. Trauma = CECT.

FAST is 1st Inv.

~~USG~~ in.

IOC for Blunt Abd. Trauma, haemodynamically unstable = FAST



COLLAPSE OF LUNG

→ Loss of aeration.

→ Evidence of volume Loss

↓

Trachea

mediastinum.

Fissure

In children. collapse of lung → F.B.

In chronic smoker → Bronchogenic Cancer

SILHOUTTE SIGN

Mediastinal Border can ~~be~~ only be obscured by pathology & are in direct contact anatomically.

Q. Aortic knob is ~~obtd~~ obscured by

(a) LUL - Ant

~~(b)~~ LUL - Post

(c) lingular

(d) LLL.

Aortic knob is in post. part
↳ Application of silhoutte sign.

(.....)- aortic knob[47]
↓
Posteriormost part of aortic arch. from where descending aorta is visible

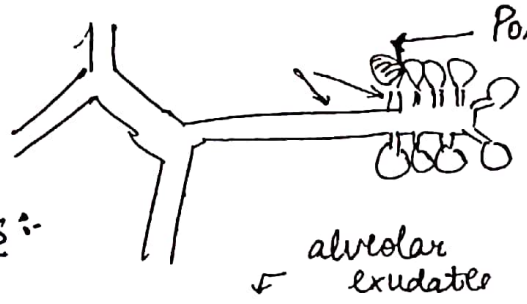
* Lingula is part of (L) upper Lobe

- LUL collapse
oblique fissure go anteriorly
Hyperinflation of lower lobe

LUL-collapse → not easy to see as. hyperinflation of LL obscures collapse of UL

Difference B/t Collapse & Consolidation
↓ ↓
Vol. Loss Vol. maintained

Q. Air Bronchogram is a sign of Alveolar Pathology



Pus spread through pores of Kohn & not by Bronchus.
⇓
So, Disease involving alveoli & not Bronchus

Causes :-
1) Pneumonic consolidation
2) Pulmonary oedema = alveolar fluid
3) Hyaline Membrane Disease
↳ alveoli collapses due to absence of surfactant but bronchus don't ⇒ air Bronchogram

If Bronchus is occluded ⇒ (B) alveole + Bronchus occluded

⇓

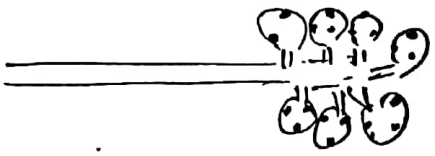
So, no air Bronchogram

⇓

* Air-Bronchogram usually absent in Bronchogenic Cancer exception. (I) adeno Ca in situ (Broncho-alveolar Ca)

Pre-invasive

Adeno Ca in situ



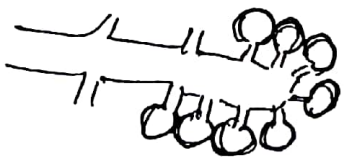
← architexture is maintained only alveole involved

(II) Pulmonary Lymphoma

Interstetial Pneumonia

* Viral Pneumonia
  Mycoplasma
  Pneumocystis carini pneumonia

} ⇒ alveole of wall are thickened
No alveolar exudate



= RETICULAR OPACITIES on CXR

Interstitial Lung Disease

Silicosis
Sarcoidosis

⇒ thickening of alveolar wall is even more

⇓

RETICULONODULAR OPACITIES on CXR

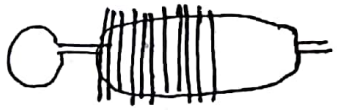
HONEY COMB LUNG - Irreversible changes in ILD.

IOC for ILD = HRCT

Thickness of section = 1-2 mm
These section are widely spaced
Then reconstruct image by Bone Image Reconstruction Algorithm.

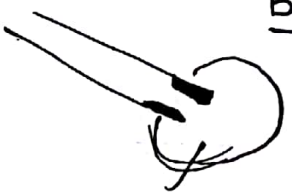
Q. HRCT of Lung Impice
a) Thick slice thickness
b) Large field of view
c) Bone algorithm.

IOC for Bronchiectasis = Volumetric HRCT



Thin contenuous section
↓
It enable 3D reconstruction of image

BALL VALVE MECHANISM



air cyst
(Pneumatocele)

In some Bacterial pneumonia
↓
air gets trapped inside, so air cyst formation occurs

1) Staph. Pneumonia
2) Klebsella
3) Hydrocarbon poisoning
4) Lung injury.

(5) Pneumocystis Jirovecii

Pneumocystis Jerovecii

= Reticular ~~pattern~~. opacities.

= Pneumatocele

~~LN~~

~~Pl. effusion.~~

ASPERGILLUS

1) Immunocompromised

↳ Angio-invasive aspergillosis

↓

Red infarcts formed around fungal

→ CT = HALO SIGN

Reverse Halo Appearance on CT Scan = ATOLL SIGN

ATOLL

(Reverse Halo)

↑

Cryptogenic organising Pneumonia

(Bronchiolitis obliterans)

Halo

↑

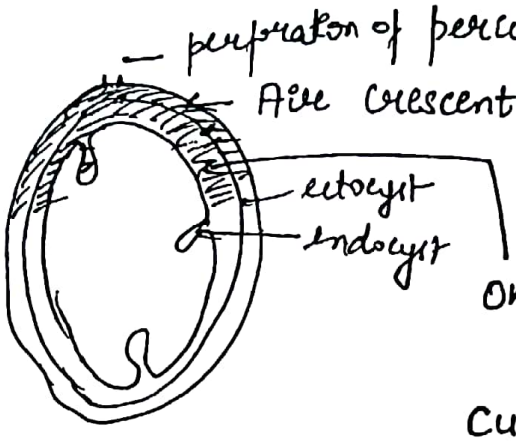
Invasive aspergillus

HYDATID

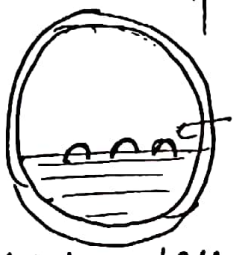
1) IOC = CECT.

2) "GHARBI" classification → USG HYDATID
(egypt endemic for Hydatid)

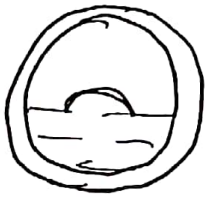
3)



If only endocyst ruptures but outer layers are intact
↳ fluid comes out



Water-Lilly sign = CAMALOTE SIGN



Rising sun sign

SIGNS ON X-RAY DEPENDENT ON ± LAYER PERFORATES

Outer Layer → air crescent sign.

Outer 2 Layers → oncon-peel

Innermost layer → ~~oncon peel~~ water-lilly or camalote sign.

DUPLEX DRAINING SYSTEM

① M/c cong. anomaly of upper urinary tract

② Weigert-Meyer Law = upper moiety drains lower in the UB → hydronephrosis → Paper thin cortex.

③ upper pole is more prone to obstruction & lower pole more prone to reflux. = DROOPING LILLY SIGN // Non-functional upper pole

④ If ureter get fused. ureteral ureteric reflux may occur YO-YO REFLUX.

Q. all these are features of CXR - HYDATID except.

a) water lily

~~b)~~ drooping lily

c) floating lily

d) Rising sign

~~Alveolar~~

Q. 21 yr old male c haemoptysis & X-ray → Canon-Ball

a) TB

~~b)~~ Testicular Tx

adolescents :-
Osteosarcoma

child :- Wilm's Tumour.

Neuroblastoma goes to Bone.

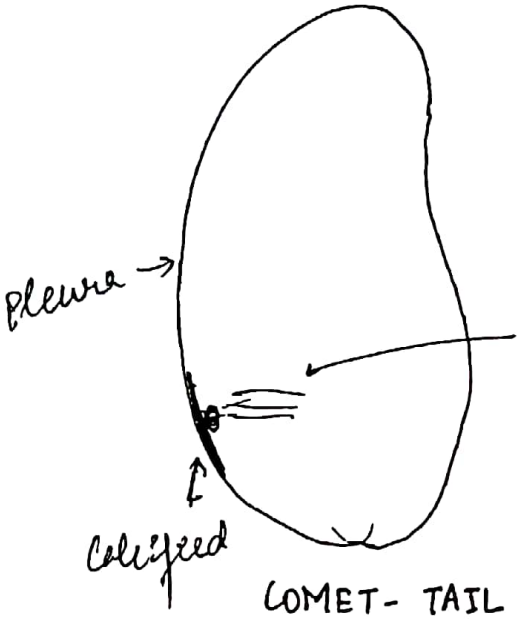
STAGING OF SARCOIDOSIS ON CXR (SCADDING'S)

① LN - 1

② LN + Parenchymal - 2

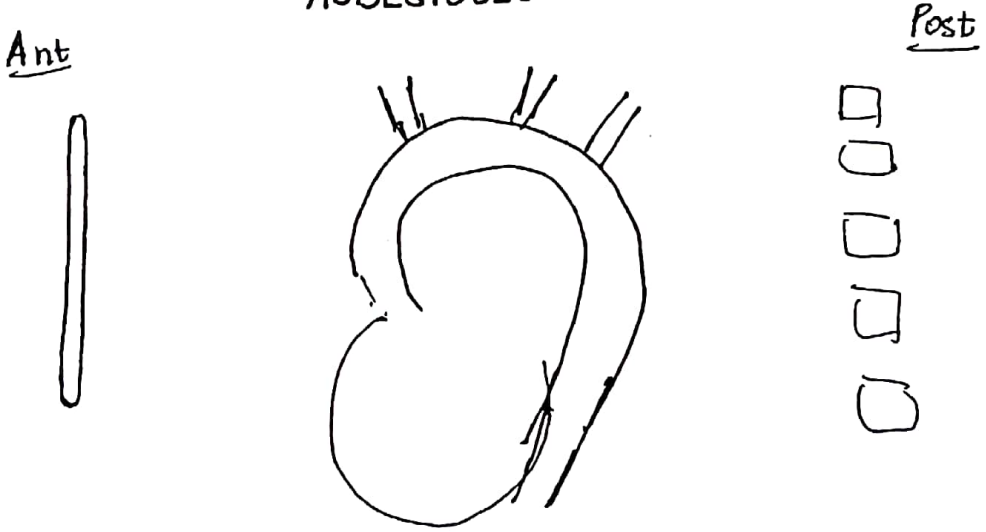
③ " Parenchymal - 3

④ Fibrosis - 4



ROUND 'ATELECTASIS'
Pleural Pathologies

COMET-TAIL SIGN on CT.
↓
ASBESTOSIS



Innominate artery

① Brachiocephalic artery

② common carotid

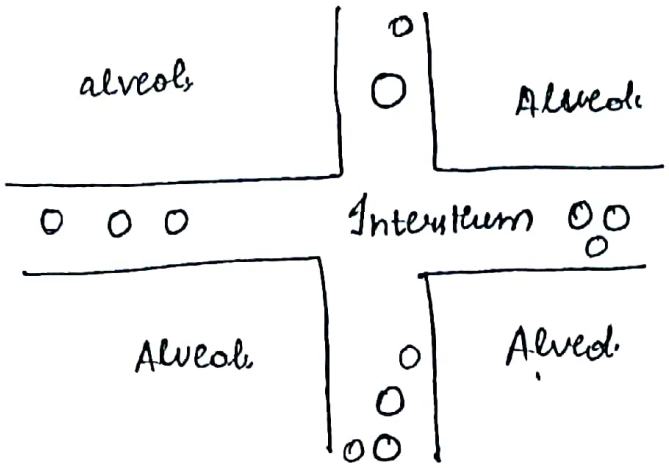
③ L. subclavian

④ Trachea.

⑤ esophagus

LV

LVF



PCWP↑
↓
~~Fluid in alveoli~~

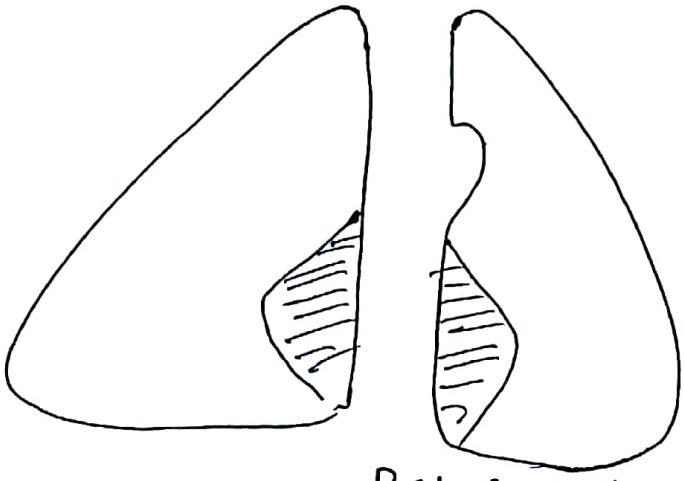
PCWP↑
↓
Fluid around ~~vessels~~ capillaries in lower lobe (LL)
(This ↓ gas exchange)
↓
Hypoxia develops in LL
↓
Vasoconstriction
↓

1st CXR = CEPHALISATION OF BLOOD FLOW

③ KERLEY A Lines

Phantom T_x = Thickening of Horizontal fenure

② LL lymphatics get [Kerley B Lines] = Horizontal lines at lung base ~~from below~~
engorged



Batwing appearance : Alveolar oedema

8-12 mm of Hg = (N) PcWP

13-19 mm Hg = Perivascular cuff → cephalisation of Blood flow
'LOWER LOBE'

20-24 mm Hg = Interstial oedema Kerley B
A
Phantom T×

>25 mm Hg = Alveolar oedema Batwing
Pleural effusion

ARDS

non-cardiogenic Pulmonary oedema

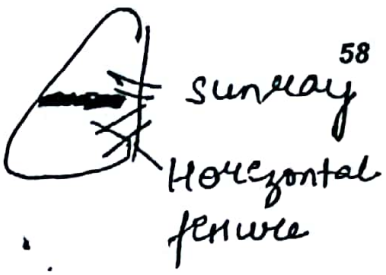
PcWP → (N)

Here, Pulmonary capillaries permeability ↑

⇓

No LL dominance
Here Diffuse Opacity occurs
No cephalisation
Cardiac size - (N)

NewBorn comes ☂ sunray appearance at hilum. + Thickened by Horizontal fissure

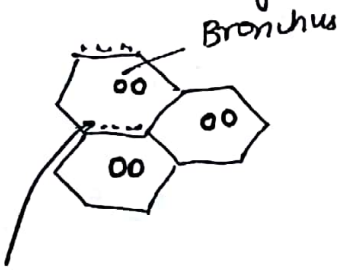


⇓

TRANSIENT TACHYPNOEA OF NEWBORN
upto 48 hrs - CXR

sunray appearance are due to lymphatics engorged

Smallest unit of lung ☂ is CT visible
= 2° Pulmonary Lobule

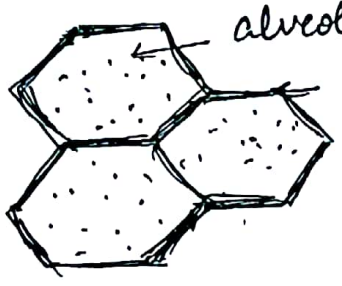


Centrilobular (Ds)
Endobronchial TB

Lymphatic (Any Disease)
Interlobular septa
⇓
Septal Lines on CT
= Kerley B Lines on CXR

KERLEY B LINES CXR. (Septal Lines on CT)

1) LVF
2) Sarcoidosis → nodules are around in lymphatics
3) Lymphangitis Carcinomatosa - cancer spreading through lymphatics of lung
⇓
Lymphatics are involved in all the 3.



alveoli filled ↓ surfactant like lipoprotein
↓
ground glass appearance

Thickened septa

ALVEOLAR PROTEINOSIS

↓

CRAZY PAVEMENT

RHD

Left Atrial enlargement ⇒ straightening of Ⓛ Border

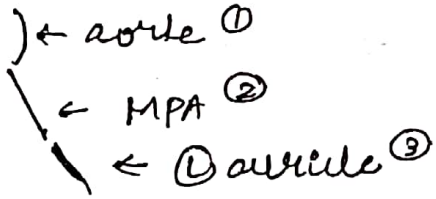
↓

Ⓛ auricle is present below MPA

Q. Earliest - CXR - RHD.

ⓐ straightening of Ⓡ Heart Border

ⓑ Bulge below MPA



3rd ~~MOGUL~~ MOGUL SIGN on CXR

If Ⓛ atrium gets enlarged due to other disease.

↳ 3rd Mogul sign is absent

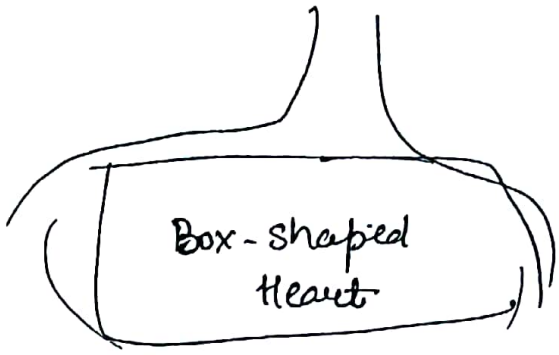
EBSTEIN'S ANOMALY

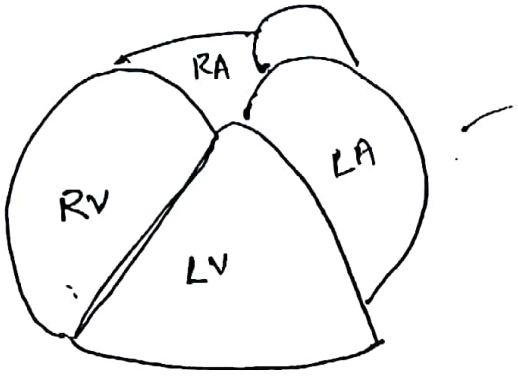
RA enlargement

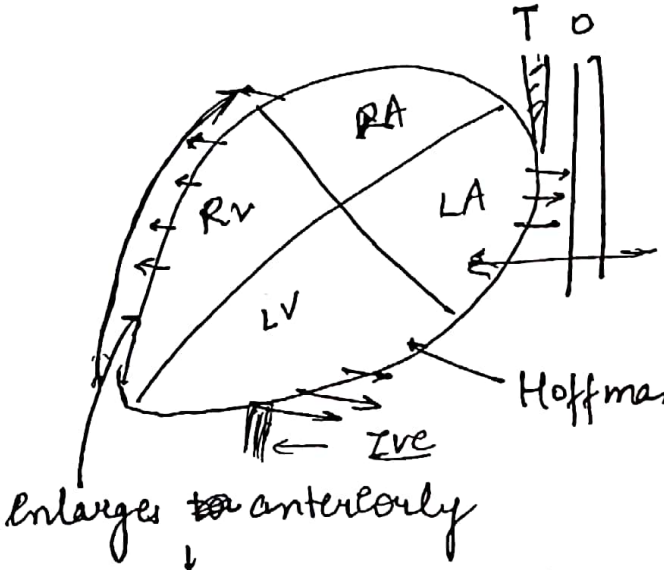
Narrow vascular pedicle as reaches below ⇒ ~~gets~~ widened

→ BOX-SHAPED HEART

→ Pulm. oligaemia







LA enlargement

→ widens carina
pushes oesophagus posteriorly

Hoffman Rigler sign.

Enlarges anteriorly

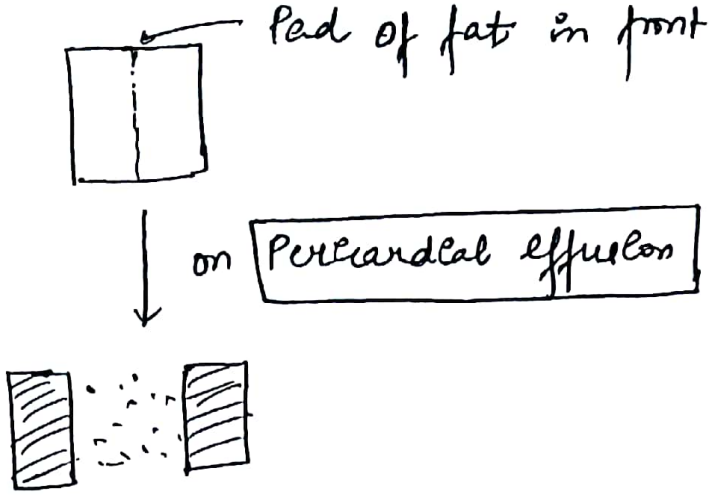
↓

Obliteration of retrosternal space

Retrosternal space widening CXR → EMPHYSEMA
⌐ on lateral chest xR

HOFFMAN RIGLER SIGN ⇒ LV enlarges posteriorly. to IVC

" MILLER SIGN – CT ⇒ ANGIOFIBROMA



Separation Epidural Fat Pads on Lateral view
= OREO COOKIE SIGN

Oligaemia =
+ Box shaped Heart = Ebstein's anomaly
+ Boot " " = TOF

CARDIAC MRI

Most accurate Inv for Ventricular Func^{n} Assesment.
(Gold Std.)

IOC → for Cardiac Tx

IOC → for Pericardial Thickness

Indicated for Myocardial Evaluation.

SCAR ASSESMENT → Delayed Enhancement

Indicated for Iron Deposit → Hemochromatosis

Apical HOCM.

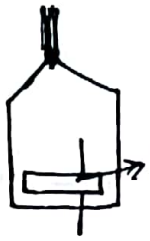
Arrhythmogenic RV Dysplasia (ARVD)

↳ fibrofatty replacement of RV wall

~~MRI~~ PET (CARDIAC)

IOC for Myocardial Vitality.

USG



↓ PIEZOELECTRIC EFFECT

Parameters

1) velocity of sound ∝ Density of medium

AIR = 330 m/s

Human Body = 1540 m/s

2) wavelength depends on thickness

$\lambda = 2T$ T = thickness

$\frac{C}{\lambda}$ = FREQUENCY

3) Frequency ∝ Image Resolution.

$\propto \frac{1}{\text{depth Penetration}}$

Routine abd. or obst. USG

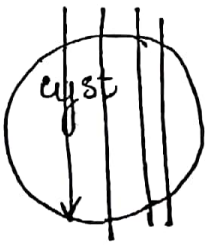
frequency = 3.5 to 5 MHz

TVS/TRUS - 5-7.5 MHz

Superficial { orbit, thyroid, Breast } 8-12 MHz

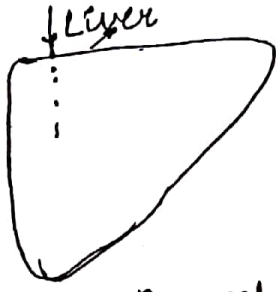
Endoscopic USG 12-20 MHz

Thats y, USG is not a good modality for Pancreas
But Endoscopic USG is a good modality for Pancreas
[Frequency Higher = good Resolution.]



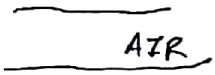
water doesn't reflect sound & let go

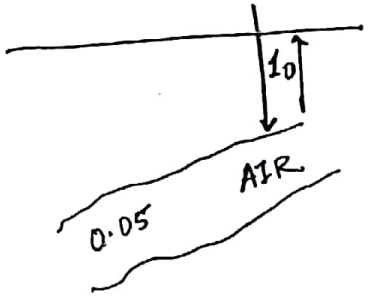
ANECHOIC
[BLACK]



Some amount to reflect & some amount of to transmit

HYPERECHOIC
(white)





→ Air filled structures on USG appears [HYPERECHOIC]

Full Bladder is req for looking at pelvic organs by abd. USG

↓

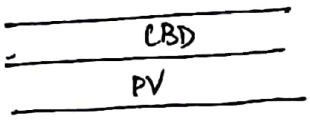
at full bladder → Bowel loops (Hyperechoic) are displaced upwards.

In TVS → empty bladder

Acoustic shadow :- Anything that reflect sound have a shadow

On USG

⇒

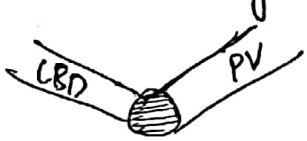


Double Barrel USG

↓

CBD obstruction - surgical

Double Duct Sign → Periampullary Cancer



IOC for Gall Stones = USG

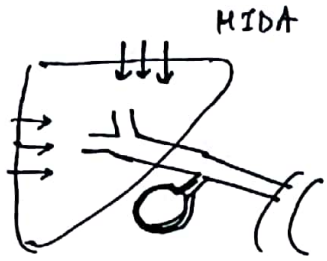
X-ray - 10% gallstones are radio-opaque

IOC for Acute Cholecystitis = USG.

↓

- Distended GB
- Thick oedematous wall
- Pericholecystic Fluid
- Sonographic 'MURPHY' +ve

BEST Inv. for Ac. cholecystitis = Tc HIDA
(Hepato-biliary Imino Di-acetic acid)

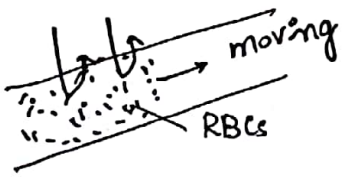


↓
HIDA taken up by liver

(N) HIDA reaches GB in 30min
But in Ac. cholecystitis ⇒ cystic duct is Blocked.
Dye can't reach there

NON-VISUALISATION GB on Tc HIDA = Ac. Cholecystitis

⇒ To differentiate Bet" soled & Cystic ⇒ USG



DOPPLER

Any moving object is producing sound will produce frequency shift

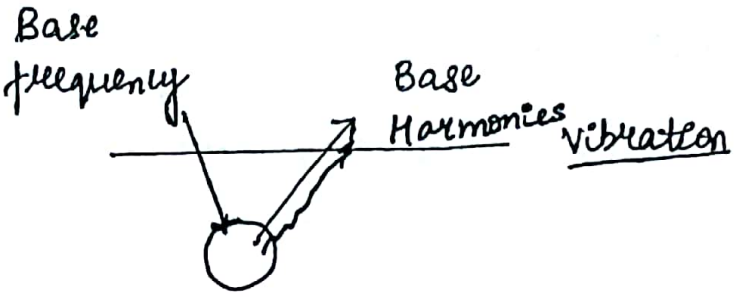
Col. ~~colour~~ Doppler is based on frequency
Colour " " " Direct

DOPPLER

① IOC - DVT

② Carotid stenosis screening

③ Testicular Torsion



Q. Tissue Harmonic Imaging now used in

a) ~~CT~~ c) USG

b) MRI d) PET

US - ELASTOGRAPHY

For Hardness of Tissue

Guide Breast Biopsy

Fibroscan. → LIVER

MRI guided HIFU

High Intensity Focussed USG

Thermocoagulation ⇒ FIBROIDS

PACS (Picture Archiving & Communication System)

Software & connects Radiology & other parts of hospital

Std Digital Format = DICOM.

(Digital Imaging & communication in Medicine)

IOC for Urinary Tract stones = NCCT

Uric Acid X-Ray → Radiolucent

CT → visible

X-Ray ⊖ } → Indinavir

CT ⊖ } → Pure Matrix stone

↓

Diagnosed on Ureteroscopy

IOC for Urinary Tract TB = CECT (Not IVP)

TB ON IVP

Calyceal irregularity = MOTH EATEN CALYCES
FEATHERY APPEARANCE OF CALYCES.

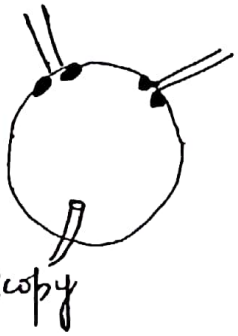
HI KED UP PELVIS

KERR'S KINK Appearance

SAW TOOTH URETER [SAW Tooth colon
↳ Diverticulosis]

Ureter → Pipe stem

Saw Tooth ureter.



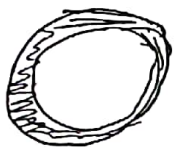
GOLF HOLE URETERIC ORIFICE on cystoscopy

cystoscopy

= THIMBLE BLADDER

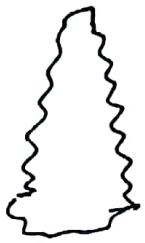
↓

Small low capacity thick walled bladder

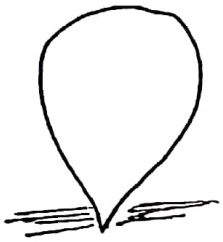


In TB → Kidney calicies
Not the Bladder
⇓
Cement / Putty /
Autonephrectomy

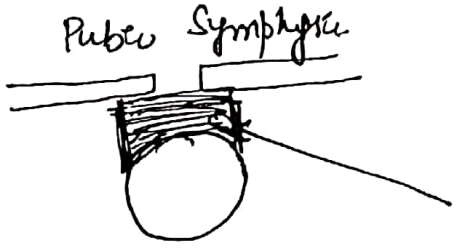
Q. Calicified Bladder, resembling fetal Skull
= SCHISTOSOMIASIS

Q. 

Elongated, Hypertrophied Bladder = Christmas Tree Bladder
Pine Tree
= NEUROGENIC BLADDER

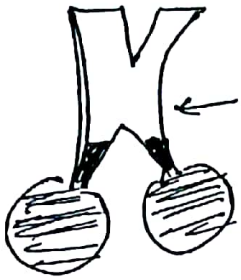
Q. 

Tear Drop or Pear
↳ PELVIC HEAMETOMA
can be seen physiologically in
Pelvic Lipomatosis.



Extraperitoneal Rupture
Dye accumulates in Pre-vesicle space
MOLAR TOOTH SIGN on CT Abdomen

Molar Tooth Sign on MRI Brain = JOUBERT'S SYNDROME
vermis absent
Mid Brain abnormal



← Superior Cerebellar Peduncle

Joubert's Syndrome

PAPILLARY NECROSIS → DM.

← egg in cup on IVP

[egg in cup in CXR
↳ Constrictive Pericarditis]

← Golf Ball on TEE Sign

← Lobster claw sign

RING SIGN

CYST

Kidney Cyst

BOSNIAK CLASSIFICATION

URETEROCELE

Adder Head appearance on IVP.

Simple cyst – 1

Calcification

Thin septa

minimally complicated cyst – 2

} Ignore

Nodular septal calcification

2F → follow up

Thick enhancing Septa

3 → indeterminate

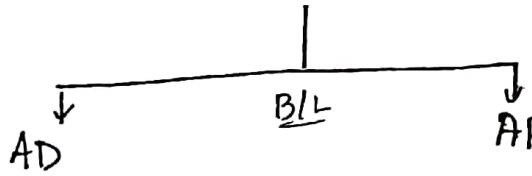
Solid enhancing

4 Clearly Malignant

} Surgical options

PCKD

2 Types



Larger cysts scattered

Dye taken up by kidney tissue not by cyst

SWISS CHEESE NEPHROGRAM

Smaller cysts radiating from hilum

Dye taken by Renal tissue not by cyst

SUNRAY - IVP

STRIATED NEPHROGRAM

SPIDER LEG - IVP

BELL-SHAPED CALYCES

MULTICYSTIC DYSPLASTIC KIDNEY

→ U/L

→ Developmental

Non-visualised kedney on IVP

↳ No renal tissue ∴ nt to take up the dye

ACUTE PYELONEPHRITIS

wedge shaped area of infarct or coagulative necrosis

⇓

"STRIATED NEPHROGRAM"

Infarcts

↓

do not take up the dye

WHITE MATTER DISORDERS

MRI is the most sensitive modality.

MS

Demyelinating

Dysmyelinating

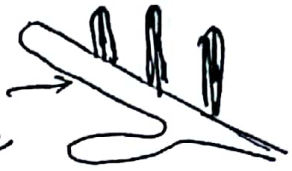
leukodystrophies

metabolic disorders

MULIIPLE SCLEROSIS

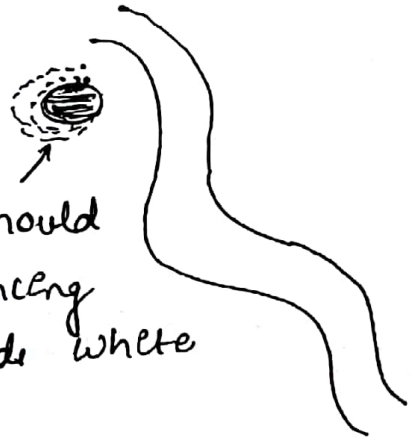
PERI-VENULAR. predominant Disorder

Ms is → white matter
Gray matter.
Both
⇓
or
white matter



DAWSON'S FINGER
⇓
⊥r to Lateral Ventricle
Best seen in "SAGGITAL PLANE"

Ms has a Relapsing Remitting course
'Active Demyelination'



Plaque should have advancing edge towards white matter.
↑
Dye when given is taken by inflammatory area.

Cq ⇒ OPEN RING SIGN
open end = cortical side

Q. Child come to you ☂ developmental delay
MRI shows ↯ Ab Ⓝ signal in white matter
⇓
Inborn error of metabolism.
[DYSMYELINATION].

Child ~ white matter ~ Large Head

ALEXANDER

1) Frontal lobe - begins. (frontal predominant)
2) Rosenthal fibres
3) Fibrinoid Leukodystrophy

CANAVAN's

1) Diffusely enters white matter

Spongiform Leukodystrophy -

MR spectroscopy = ↑ NAA

[ASPA → aspartoacylase → Breaks NAA]

* "Subcortical 'U' fibers are spared."

① KRABBE → globoid leukodystrophy [THALAMIC]

② Metachromatic Leukodystrophy ⇒ arylsulphatase A deficiency

← perivenular sparing ⇒ TIGROID PATTERN

~~Peroxisome~~ ~~Dis~~

* Peroxisome Disorder, * Xx linked Adrenoleukodystrophy

Occipital Predominant

Lorenzo's oil → effective in this disease

Q. PML (Progressive Multifocal Leuko encephalopathy)

Seen in HIV pt

caused by JC virus

↓

involves oligodendrocytes

↓

no myelination

Usually PML is non-enhancing (don't take up dye) bcoz there is no inflammation. so BBB is preserved.

* CHRONIC ISCHAEMIA [white matter problem due to chr. ischemia].

age related narrowing

Subcortical arteriosclerotic Leukodystrophy (BINSWANGER DISEASE)

presents ī dementia

GENETIC CAUSES (notch-3 mut^n)

(CADASIL)

Cerebral autosomal Dominant arteriopathy Subcortical & infarction & leukodystrophy

↑ M/c form of hereditary stroke Disorder.

CJD

→ prion Disease

→ cortical Spongiform [Grey Matter]

↓

- Cortex
- Caudate
- Putamen

RING ENHANCING LESIONS

NEUROCYSTICERCOSIS

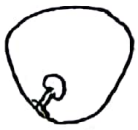
Vesicular

* Initially NCC is alive [viable stage]

↓

VESICULAR STAGE

(filled ī clear water)



cyst ē scolex

Membrane is intact in vesicular stage

↓

So, no surrounding inflammation

↓ → No BBB damage

So, **non-enhancing**

Colloidal

* When parasite is ~~dying~~ degenerating

↓

fluid becomes turbid [COLLOIDAL STAGE]

↓

membrane will degenerate

↓

attack by immune system

↓

Now BBB damage

↓

Dye is taken up

↓

Ring Enhancing Lesions

↓

Granular stage

on MRI – Thick walled enhancing Lesion.

Dead stage

No inflammation

No enhancement

Nodular calcified

TOXOPLASMOSIS

→ Ring enhancing Lesion
→ Eccentric nodule
→ HIV +' pts

BRAIN ABCESS

Ring enhancing Lesion
Pus in centre → thick & Viscous.

Diffusion ~~restr~~ wated. – MRI = Bright

METASTASIS

M/c site :- Grey-white matter Junction

THYROID OPHTHALMOPATHY

COCA-COLA BOTTLE appearance

Tendon is (N)
Body of M/s Bload

BRAIN TUMOURS

1> C Tx shows Calcification
"CA^{2+} COME"

C → Craniopharyngioma
A → astrocytoma
C → choroid plexus papilloma
O → oligo dendroglioma
M → Meningioma
E → Ependymoma

Q. ⊆ of the following Brain Tx is Not Glioma

a) astrocytoma

b) ~~Glioma~~ ganglicytoma → Neuronal cell origen Tx.

c) Ependymoma

d) oligodendroglioma

Q. Neurocytoma → neural cell origen Tx

Q. GANGLIOGLIOMA → (B) glial + neural origin

Q. Child has large head. CT scan reveal calcified Tx. in his lateral & ventricle. III. IV ventricles are dilated.

Ans → Choroid plexus Papilloma

overproduction Hydrocephalus.

OLIGODENDROGLIOMA -

1) glial Tx ⊆ has cortical extensions.

↓

H/O seizure

2) show calcification.

3) Frontal lobe of Brain.

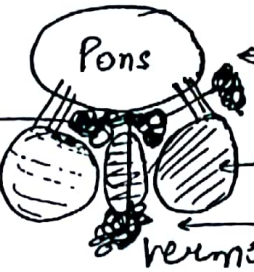
- FRIED EGG APPEARANCE on Microscopy
- CHICKEN WIRE LIKE VASCULATURE

EPENDYMOMA -

Glial Tx

children → 4th ventricle

adult → Spinal cord & Supratentorial Region



↓
Shows CSF spread
contigous
↓

hence from IV ventricle it spreads to
Cisterna magna & CP angle Cistern.

Q A young man comes to you c headache. MRI shows man in IVth ventricle extending into surrounding CSF spaces

Ans → Ependymoma

CP Angle Tx

1> Vestibular schwanoma

2> Meningioma

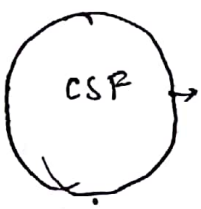
3> Epidermoid cyst
↓
Rich in keratin like fluid

Epidermoid cyst

Brownian Motion (-)
So, Non-enhancing
DW-MRI - Bright

VS

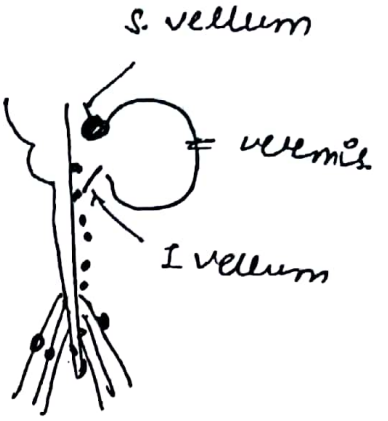
- Arachnoid cyst



→ located in middle cranial fossa

4) Ependymoma
It spread to CP angle

MEDULLOBLASTOMA



1) Posterior Fossa "midline"

2) It arises from vermis & sup. medullary vellum.

3) malignant Tx
↓
Invades sup. part of IV th ventricle.

4) Earlier considered PNET (Primeteve neuroectodermal Tx)
↓
from WHO 2016 ~~no~~ term ~~can~~ has been.
changed to "Embryonal Tumour"

5) Radiosensitive Tx

6) The flow of CF in IV th ventricle causes
CSF-DROP metastasis ⇒ Leptomeningeal Metastasis
↓
to spinal cord

↓
Sugar Icing or coating - MRI.
" or "
" Zuckerguss "

CRANIOPHARYNGIOMA

Histologically

Adamantenous	Papillary
"C"	
Cystic	solid
Children	Adult
Calcification.	no calcification.

GLIOBLASTOMA ⇒ Butterfly glioma

→ Tx is condensed in centre due to condensation of fibres in corpus callosum.

→ Crosses Midline, highly malignant

→ Other Tx & crosses Midline ⇒ "Lymphoma"

↓

HIV ptr.

Steroid Responsive Tx

↓

So, Biopsy should be taken before starting steroid

MENINGIOMA

Dural Based Tx on MRI

Dural Tail Sign.

Shows intense enhancement becoz of extra-axial Tx location.

Mother-In Law Sign.

Hyperostosis skull

VESTIBULAR SCHWANOMA ← CP angle Tu

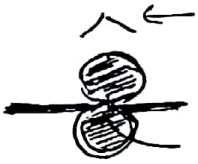
H/o - Hearing Loss
Tinnitus.

Macroscopic Microscopic finding → Antony A
" B
Verrucoary Bodies.

On MRI → Ice-cream cone appearance

Associated ↑ - NF -2

PITUITARY ADENOMA



Diaphragma sella → to protect from pressure
opening for infundibulum

Macroadenoma if size >10mm

Signs on MRI:-

1) Snowman.
2) Cottage loaf
3) figure of 8

Congenital deficient diaphragma sella

↓

ICP pushes pituitary

↓

causes ballooning of sella

" EMPTY SELLA SYNDROME " - 1°

2° → Pseudotumour cerebri
Due to Tetracycline
Vit A ~~ove~~ toxicity

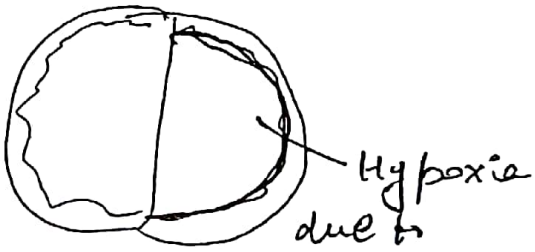
→ J-shaped sella
  ↳ seen in Mucopolysaccharidoses.

→ X-Ray skull.
  erosion of post clenoid procen → [Earliest x ray sign of Raised CT]

NEUROCUTANEOUS SYNDROME

1) STURGE-WEBER SYNDROME or ENCEPHALO-TRIGEMINAL ANGIOMATOSIS

Port wine stain.
H/o seizure
Not inherited Disorder
No Brain Tx
Congenital Glaucoma



2) TUBEROUS SCLEROSIS

AD
Seizure + MR + Adenoma sebacea
Cardiac Tx associated ∅ Tuberous sclerosis
= "Rhabdomyoma"

CMV infn → Periventricular calcifications.

Tuberous sclerosis has also association ~ Pecomas of Lung

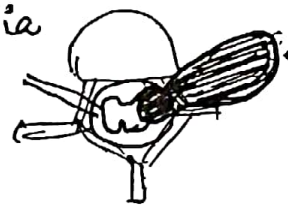
Q. A smoker comes ~ Honey comb lung in upper lobe. Bizzare arrangement.. Dx?

Ans :- LCH (Langerhans cell Histiocytosis).
↓
Eosinophilic Granuloma

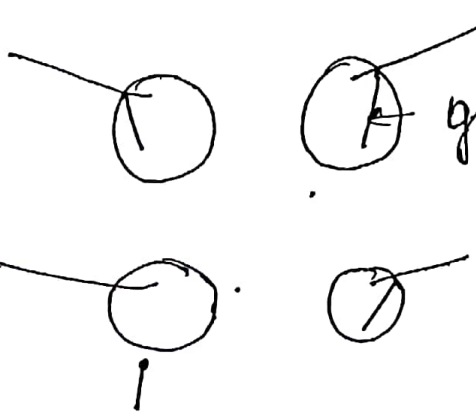
NF 1

1) Cafe-au-lait spots (~~cost~~ coast of California)
2) Peripheral + Spinal NF
3) Plexiform NF
4) ~~M~~ associated ~
   Mesodermal Dysplasia
   ↓
   Skeletal / Bony Defects
   +nt
   ↓
   Sphenoidal Dysplasia

smooth..



← Dumble Tumour



Lesser wing of sphenoid
greater wing of sphenoid

Empty Bore orbit sign
↑
due to absence of greater wing
≃ is due to sphenoidal Dysplasia

BONE Tx

5 steps ∘

1> Look ~~for~~ whether
- Immature
- Mature

2> Location
- a) single / multiple
  - 1° → metastatic
- b) Bone
- c) where in the bone –
  - Epiphysis
  - Metaphysis
  - Diaphysis

3> Pattern of destruction
- Well marginated → Geographic Lytic Lesion.
- ⟷
- Permeative → Moth Eaten

4> Matrix

Osteoid
- Ivory
- Homogenous

Chondroid
- Stippled
- Flocculent or Popcorn
- Arcs
- Rings

* Lung Hamartoma ⇒ CXR → Popcorn appearance 85

* Pulmonary Chondroma → associated c GIST.

Paraganglioma

CARNEY's TRIAD

↓

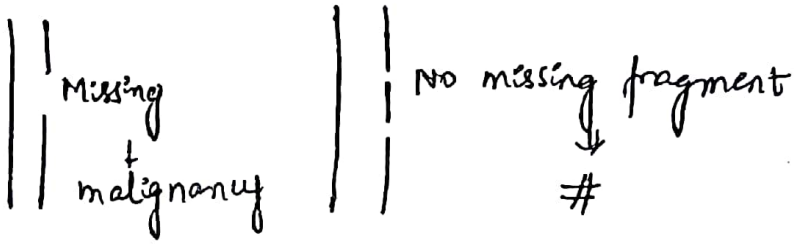
Pop-corn.

57 Beyond the Bone or not

↓

a) cortical Break → can also be due to #.

b)



b) Periosteam elevated ⇒ Periosteal Reac

⇒ Acute osteomyelitis

continuous lamellar periosteal reac.

⇒ Chronic osteomyelitis

Osteoid osteoma

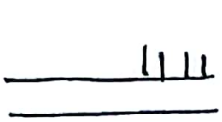
Solid

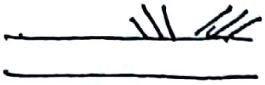
⇒ Tx groups in sports

Multilamellar

= Onion Peel X-Ray = EWING's SARCOMA

Periosteum is attached to Bone by Sharpy's fibres.

 → Spiculated → EWING's SARCOMA (less aggressive)

 → Divergent mineralisation of sharpy's fibres
↓
OSTEOGENIC SARCOMA. (more aggressive)

 → CODMAN Δ
↓
malignancy

BENIGN LESIONS IN BONE

1) HAEMANGIOMA
found in vertebra

2) LIPOMA

METASTATIC
↙
Osteoblastic
Prostate
Breast

↓
osteolytic
Breast

→ Pulsatile
Thyroid
Rcc

DEXA Scan.
↓
Bone Mineral Density.
Osteoporosis

Z score = comparing Bone Density of same age & same sex

T score = comparing Bone Density to young age

WHO scoring.

Tscore < -2.5 ⇒ osteoporosis

Tscore -1 to -2.5 ⇒ osteopenia

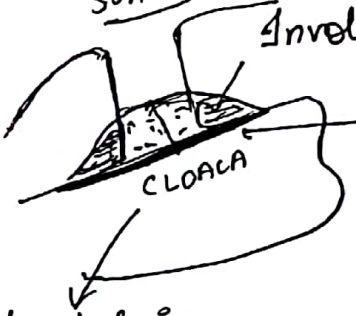
Rx - Bisphosphonates

Acute OM

Earliest X-Ray Sign ⇒ Blurring of tissue planes or soft tissue swelling

7-10 Days ⇒ Bony changes

IOC ⇒ MRI. → marrow oedema (24-48 hrs of onset) using STIR



Involucrum ← new Bone formation.

sequestrum :- Dead Bone ↓ Dense on X-Ray as no demineralisation occurs.

PATHOGNOMIC OF CHRONIC OM

Sinus hole in involucrum [PYOGENIC OM]

Pyogenic OM → bony extensive new bone

TB OM :- osteoporosis ++
almost no periosteal reac°
no new bone formation

MADURA MYCETOMA

MRI :-

oedema
fungal lesion

DOT In A circle sign

ARTHRITIS

OSTEOArthritis

- Wear & tear of articular cartilage
→ Loss of joint space in wt. Bearing (medial tibio femoral compartment)

Horizontal spurs.
↓
~~Osteo~~ osteophytes
↓
- Subchondral sclerosis
- cyst
- Loose Bodies

RHEUMATOID arthritis

Synovial Inflammation

Hyperaemia
- Periarticular Osteoporosis

- Bare area – erosions as ∴ inflammed synovium initially eat up Bare area
- Joint space narrowing (~~no~~ symmetrical)
- Dislocated Deformities
  - swan neck
  - Bountiniere
- Deformity ∵ out erosions
↓
SLE
JACOUD's Arthropathy

TB Arthritis

Inflammatory Jt. Disease

Hyperemia

↓

Periarticular osteoporosis ← earliest sign of TB knee

↓

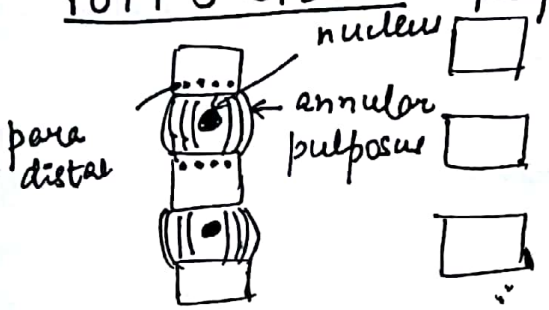
Erosion

↓

Joint space narrowing

Phemister's TRIAD

POTT'S SPINE



Blood supply of Disc → "AVASCULAR"

earliest finding in TB spine → "Disc space narrowing"

~~People not consuming~~

~~GIA~~

BRUCELLOSIS → OM of spine

People not consuming pasteurized milk

Anterosuperior corner →

PEDRO PON SIGN

Q. On X-Ray -

Density ↑
Debris +
Distension.
Dislocation
Disorganeze

→ Related Trauma
↓
Neuropathy.

Ans - CHARCOT'S JT
↓
eg in. DM.

⇒ 1st MTP

← Punched out
← Rat Bite erosion
↓
away from articular surface
} ⇒ GOUT

⇒ PSEUDOGOUT → Deposit of CPPD (calcium pyro-phosphate deposit).
↓
Chondrocalcinosis.

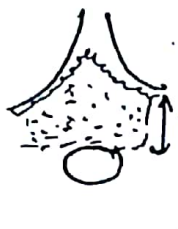
⇒ In DIP  Pencil in cup ⇒ PSOARIATIC. ARTHROPATHY
↓
Bone Density (N)

METABOLIC DISEASES

Osteoid
↓
mineralization

1> RICKETS

Earliest X-Ray finding → Loss of provisional zone of calcification.



→ splaying cupping ~~Rta~~ Fraying of growth plate Widening

On giving Vit D → Recovery of provisional zone (Healing Rickets) ↓ White Line of Frenkel.

OSTEOMALACIA

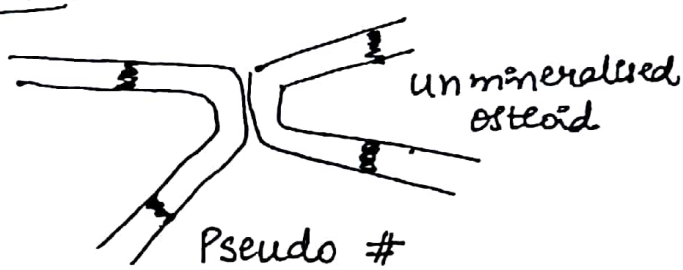
symmetrical

PELVIS

Looser's Zone seen in

1) Pubic Rami
2) Neck of femur

Ribs
Scapula (outer)

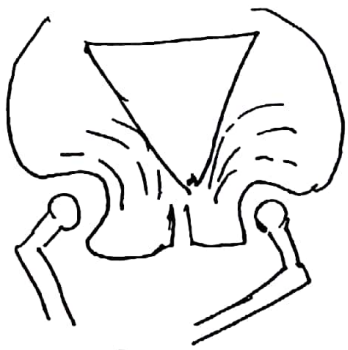


Pseudo #

LOOSER'S ZONE

Disease ∈ Looser's Zone

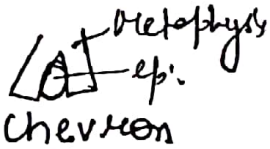
1) Osteomalacia
2) Fibrous Dysplasia
3) Paget's Disease



TRIRADIATE PELVIS (Pelvic cavity gets triangular)

Champange Glass Pelvis ⇒ **ACHONDROPLASIA**

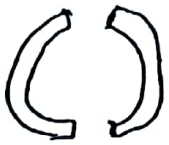
- AD
- Rhizomelic Dwarfism (proximal Bones shorter)
- Trident Hand
- ~~Arthritis~~ lumbar canal stenosis.
- Foramen Magnum stenosis



Chevron Sign

THANATOPHORIC DWARFISM

- Lethal cond"
- ß.



"Telephone Handle Long BONES"

P

* EPIPHYSEAL ENLARGEMENT :-

1) JRA (In child)
2) Hemophilic arthropathy
3) Bony Dysplasia → TREVOR's

* EPIPHYSEAL DYSGENESIS:-

1) Hypothyroidism
   - ↳ Delayed Bone Age
   - ↳ Wormian Bones ← Prominent Intrasecutural Skull Bones.
     - ↓
       - Osteogenesis Imperfecta
       - Down's Syndrome
       - Rickets
       - Pyknodystosis.
       - Hypothyroidism

Osteogenesis Imperfecta → Diaphyseal #
⇒ Different stage of Healing
(Battered Baby syndrome)

In accidental trauma → same stage of healing

* SCURVY

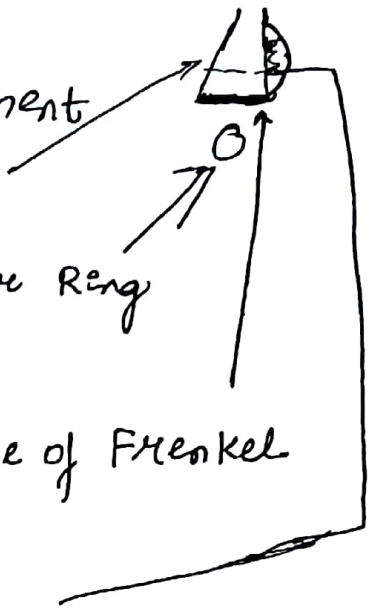
Osteoid formation ↓

In copper Deficiency ⇒ Pseudo scurvy

Osteoid

↓

Mineralization



Thin Bones → only margen is prominent (Pencil thin cortex).

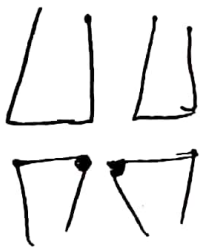
Wimberger Ring (Epiphysis).

Provisional zone become dense ⇒ White Line of Frenkel

Mineralization doesn't occur in the area ⇒ Scorbutic zone or Trummerfeld zone

Pelkan spur

Cong Syphilis



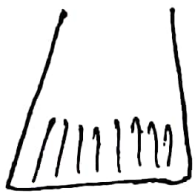
Erosion tibial Metaphysis ⇒ Wimberger sign

⇓

"Congenital syphilis"

Cong. Rubella

striations.



Celery stalk

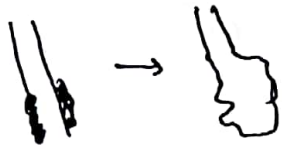
ANKYLOSING SPONDYLITIS

Sero -ve spondylite

Earliest sign → Sacroiliitis *

IOC ⇒ "MRI"

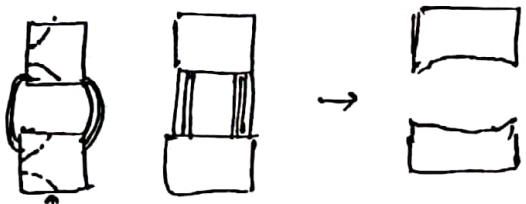
X-Ray 1st → Blurring of subchondral cortex on. (iliac) side of SI jt.



→ Pseudowidening SI joint

Changes in vertebra are due to Enthesis - itis

↓ where tendon & ligament are inserted



ROMANUS LESION

SHINY CORNER SIGN.

ANDERSON LESION

↓

Inflammation of Disco-vertebral junc".

in ankylosing spondylets ⇒ through & through (CARROT STICK #)

← syndesmophyte

↑ vertically arranged outer Disc fibres

↓

BAMBOO SPINE

DAGGER SIGN

(Internal Disc fibres)

PAGET'S DISEASE

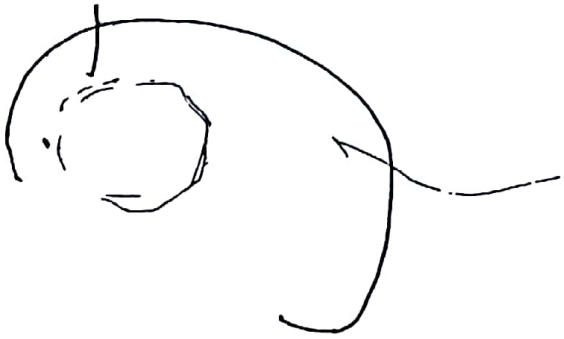
MOZAIC
- Lytic
- Mixed
- Blastic

Initially → osteolytic Lesions

Osteoblastic lesions
↳ cotton wool spots

skull becomes elongated

osteoporosis circumscripta



"TAM O SHANTER" SKULL
Scottish cap

← Blade of grass.

Signs

Skull
cotton wool
Osteoporosis circum-scripta

Tam o shanter skull

spine
Picture frame ivory

Long Bones
Blade of grass

OSTEOPETROSIS

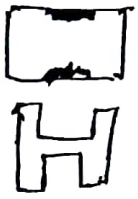
Defect of osteoclast

THALASSEMIA

Diploic Widening
Hair on end skull

SICKLE CELL ANAEMIA

Bone Infarct
Snow cap Humerus →



H-shaped vertebre

LEUKEMIA

Presence of Metaphyseal Lucency

NUCLEAR MEDICINE

nuclear scan Scintigraphy	SPET	PET

NUCLEAR SCAN

M/c isotope — Tc^{99M} → metastable isomer.

$t_{1/2}$ → 6 hours

Produced by Molybdenum Generator

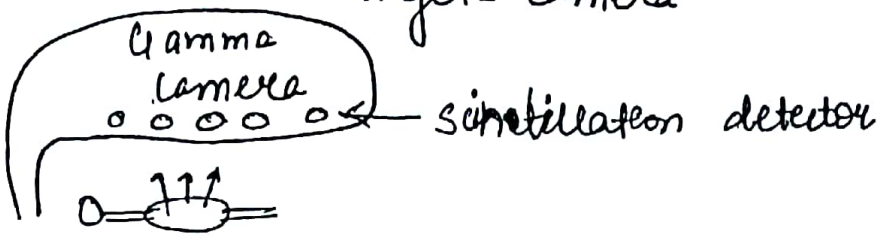
- Gamma rays

  Energy → 140 KeV

LIGAND → Tc - HIDA

Tc - MDP

Anger's camera



Cardiac scintigraphy

Myocardial Perfusion scintigraphy	Myocardial Infarct scintigraphy
Thalium Tc - Tetrofosmin Tc - Sestamibi Ischaemia → COLD	Tc - Pyrophosphate ↓ Bind to infarcted tissue Infarct → HOT

Tc - RBC MUGA scan → [multi-uptake Gated Acquisition]
↓
ventricular func^{n}

[Most accurate Investigation for ventricular func^{n} = MRI]

DYNAMIC RENOGRAM

Tc - MAG3	Tc - DTPA
↓	↓
Tubular Secretion + GF	Purely GF
↓	
Assess Renal func^{n}	Assess. GFR

STATIC RENOGRAM

- Tc - DMSA
- Structure
- Scarring
  ↳ Reflux
- ~~Post urethral valve~~

VUR - IOC
↓
MCU
PUV

Assess Distribution of Renal Func^{n}.

* T_c - RBC
  To localise the site of lower GI Bleeding as little as 0.1 mL/min

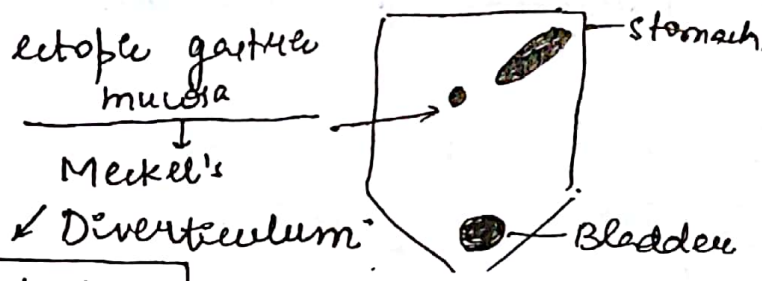
* T_c Heat Damaged - RBC
  To ~~localise~~ look for residual Splenic Tissue post-Splenectomy

* T_c - Pertechnatte
  Physiologically → choroid plexus
  - salivary gland
  - Thyroid
  - Gastric mucosa

Salivary gland

Only ↑ salivary gland T_x HOT on T_c-Scan
⇒ Warthin's T_x (OR)
⇒ Adeno-Lymphoma

Gastric Mucosa



IOC = T_c pertechnate

* T_c - Sulfur colloid.
  Taken by - macrophages
  - Reticulo endothelial system
  ~~Liver~~
  Liver of Kupffer cells tht

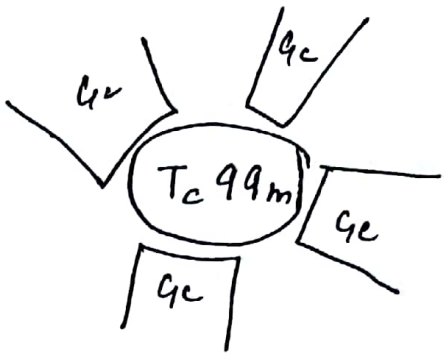
Q Hepatic Lesion. Rich in Kupffer HOT or T_c - colloid scan
⇒ FNH focal nodular Hyperplasia

SPECT

Single Photon Emission computed Tomography.

- Tc^{99m}.
- I-123

3D



multiple gamma cameras.

* **Tc - SESTAMIBI SPECT**

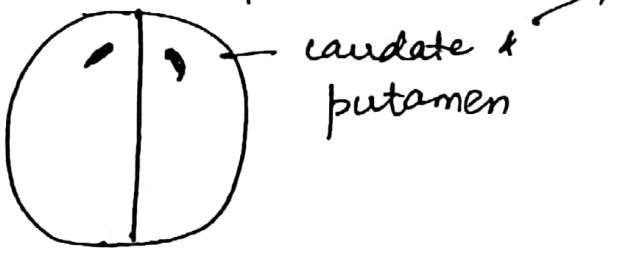
→ Used for 3D localization of Parathyroid Adenoma
→ for Myocardial Perfusion

* **Tc^{-} HMPAO - SPECT** at NIMHANS

- cerebral Perfusion

* **DAT SCAN**

I^{123} Isoflupane ⇒ COMMA SHAPED appearance (N)



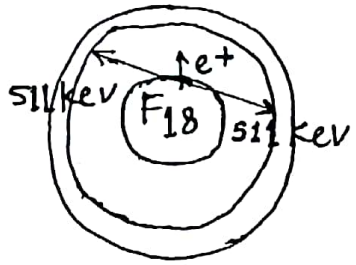
In parkinsonism
• • → "period"

PET Scan
(Positron Emission Tomography)

- Cyclotrone Generated Isotopes
  ↓
  portable ~~accelerator~~
  accelerater

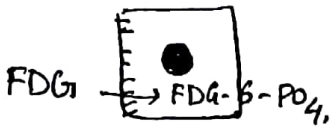
$$\xrightarrow{\text{Protons}} O_{18} \leftrightarrow \boxed{F_{18}}$$

$t_{1/2}$ - 110 min
(short lived)



Positron. (e^+)
Anti-matter
+
e^- electron MATTER
Annihilation.

18 Fluoro - Deoxy Glucose (FDG).
↓
non-metabolisable Glucose analogue



'WARBURG EFFECT'

Cancer cells have
more glucose transporter → Aerobic Glycolysis

Cancer cells take up FDG & form FDD-6-PO_4.
But it doesn't undergo glycolysis.
↓
So cancer cells now emit radiation due to FDG
↓
so used in • staging of cancer
• Recurrent Tumour

• Response to therapy
↓
as metabolism ↓ first than the size of Tumour on chemotherapy

Drawbacks of FDG

1) **Hyperglycemia**
FDG will not be taken up in case of hyperglycemia due to competitive ⊖ of GLUT receptor.

2) **Tx ⊛ ĉ low metabolic Rate**
→ carcinoid } FDG ⊖ Tx.
→ BAC

3) **Brain.**
glucose hungry organ.
High uptake of FDG.
So, Brain Tx are missed
Brain is **FDG - avid**

4) **Brown Fat**
metabolically active fat (thermogenic) found in supraclavicular area
So, ↑ uptake of FDG in this region.
* B/L symmetrical supraclavicular uptake of FDG
↳ Physiological

Prevention / Menemze
→ Keeping pt warm
→ Pre-medication ĉ BZD.

Alternatives to FDG

① C_{11} - methionine PET
Preferred for **Brain** Tx evaluation. (NIMHANS)

② NaF PET
for **Bone** Metastasis
Better than MDP

IOC for clinically suspect Phaeochromocytoma
= **MRI Abdomen**

Extra-adrenal → Paraganglioma

On MRI → Light Bulb Sign
→ Hepatic Haemangioma
→ Meningioma
→ Phaeochromocytoma

Light Bulb appearance on X-Ray
Post Dislocation of shoulder.

[ℂ Dislocation is more easily diagnosed by X-Ray
↳ Anterior Dislocation.]

Extra-abdominal Phaeo = **Paraganglioma seeking Isotope**

③ ~~F~~Fluoro DOPA PET

④ I123 MIBG.
(norepinephrine analogue)

⑤ 68- Gallium DOTATATE PET Scan.
DOTATOC

— Neuroendocrine Tx. (for sarcoidosis - 67 gallium)

⑥ 68- Gallium PSMA PET
[Prostate specific membrane Antigen]

→ for prostate malignancy

⑦ PET/CT

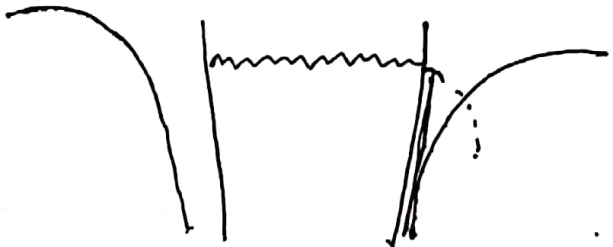
⑧ PET/MRI

PROSTATE

→ MRI is preferred

→ PIRADS

Ioc for **Fistula In Ano** → a) Fistulogram
b) MRI
c) CT
d) PET



Intersphincteric.

MRI → Due to relation of sphincters to fistula

LUTETIUM - 177

$t_{1/2}$ - 6.7 days

Strong β emitter, weak γ emitter

* **Lu - DOTATATE**

used for inoperable neuroendocrine Tx.

RADIOEMBOLISATION

- used in Liver Tx:

Radioactive agent through catheter directly to Liver

↓

Yttrium - 90 microspheres

"Pure β rays".

Phosphorus
Strontium
Samarium
} Bone seeking β emitter

Phosphorus	Strontium
1) β- emitter	β- emitter
2) More penetrating power	Less
↓	
3) marrow suppression S/E	safer

RADIUM - 223

$t_{1/2}$ - 11.4 days.

- α- emitter
- Bone seeking

~~Damage Tx~~

more safe than strontium as less penetration.

I^{123} - $t_{1/2}$ → 13 hours

I^{125} $t_{1/2}$ - 60 days

I^{131} $t_{1/2}$ - 8 days

I^{124} → PET Scan

I^{127} → Stable iodine isotope

I^{123} — ✓ cyclotron generated
✓ Gamma emitter
✓ Function.

I^{125} — ✓ for RIA
✓ Brachytherapy

I^{131} — ✓ Produce both β & γ
β - Well differentiated thyroid cancer
γ - Imaging

I

TELETHERAPY / EXTERNAL BEAM.

⇒ M/c method of Radiotherapy

Machine used → ⇒ Cobalt machine

$Co\ 60$ → artificial

$t_{1/2}$ = (5.2) years.

$Co\ 60 \longrightarrow Ni\ 60 + \beta + (\gamma)(1.25\ MeV)$

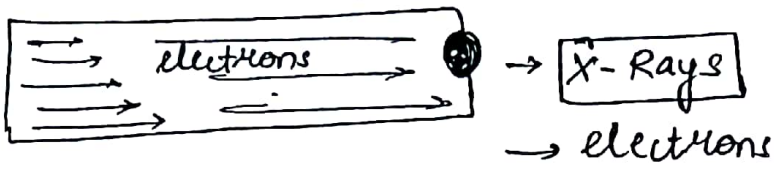
β

↳ gamma rays are killing Tx.

Drawbacks :-

1) Decay products
2) Half life
3) Fixed energy emission.

Hence, Nowadays machine used = LINAC (Linear accelerators)



≈ M/c radiation used in cancer therapy → X-Rays
≈ M/c " for deep seated Tx → X-Rays

≈ electron used for superficial lymphoma
↓
"MYCOIDES FUNGOIDES"

Intra-operative RT

LINAC Vs COBALT

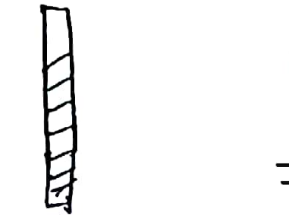
No isotope related concerns
No half life
Switch off/on.
Alter energy → orthovoltage.
→ supervoltage
megavoltage (MV)

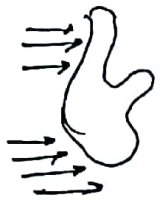
Maximum skin Burns.

a) cobalt
b) orthovoltage
c) supervoltage
d) megavoltage

CONFORMAL RT

Intensity modulated RT





⇒ intensity is conforming to 3D shape & Relationship

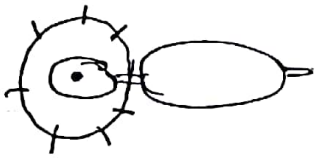
Used in
- Prostate
- Head & Neck

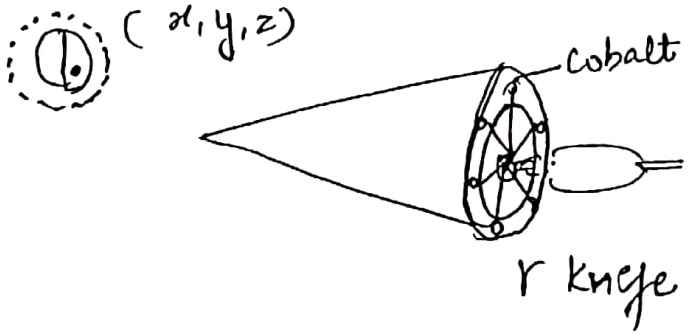
STEREOTACTIC Radio Sx

Gamma knife → invented by LAR LEKSEIL
used for Brain

Indications
1) Vestibular schwanoma
2) Pituitary adenoma
3) meningioma
4) Trigeminal neuralgia
5) cerebral metastasis < 10
6) AV malformation

lekseil's Frame





γ knife

Focussed γ radiations on Tx

↓

Initially cell swell

↓

DNA gets damaged

↓

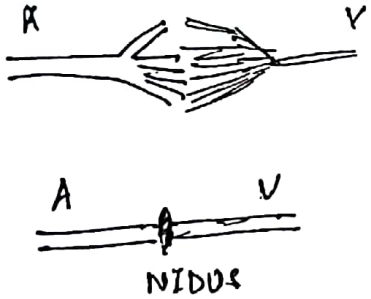
then shrinking

 → if Tx near optic chiasma

↓

γ-knife wdn't be used as it swells initially

AV malformation



HTN Bleed

1) Putamen
2) Caudate
3) Thalamus
4) Pons
5) Cerebellum

Q. Young pt in emergency shows lobar Hge

⇓

may be AV Malformation

Q. old pt c non HT lobar Hge.

⇓

Amyloid angiopathy.

↑ ka knife causes thrombosis of nidus

↓

thus damaging malformation.

* STEREOTACTIC Body RT / cyberknife

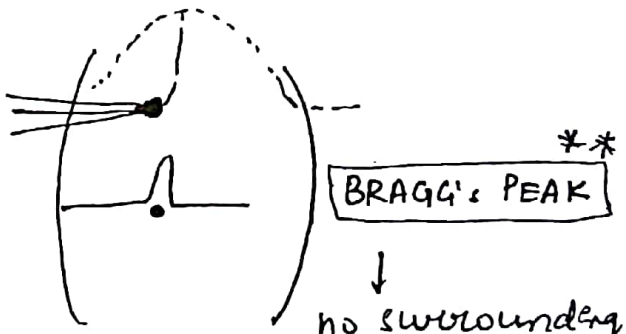
→ Based on LINAc

→ Whole Body

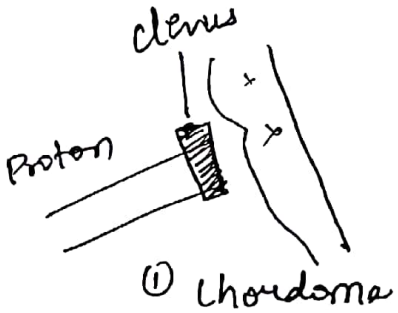
→ Frameless

* PROTON BEAM THERARY

X-Ray } Gamma ~~rays~~ waves.
↑ Ray. } Photon.



protons -
heavy
charged.



① Chordoma

② Pediatric Brain Tx → Sx is preferred. compared to RT
But now ↑ role of proton
Beam therapy.

③ Uveal Melanoma

BRACHYTHERAPY

→ Done for in contact cavity substance.

Adv :-

→ High Dose To Tx

Disad :-

Radiation exposure to Doctor

REMOTE AFTER LOADER -

→ new update

→ ↓ radiation exposure to doctors

M/c isotope used in Brachytherapy → ① Iridium 192
$t_{1/2}$ - 74 days

② Cesium - 137
$t_{1/2}$ - 30 years.

TYPES

- Low Dose: 0.4 to 2 Gy/Hr
- High Dose: >12 Gy/Hr

* Permanent Implants
  - ✓ Palladium
  - ✓ I - 125

Gold → for malignant ascites.

oldest isotope → Radium 226
$t_{1/2}$ → 1600 yrs.

Radium no longer used bcoz of harmful Decay products.

Environment:

Outdoor ← → Indoor

RADON
- $t_{1/2}$ – 3.8 day
- lung cancer.

How to measure Radiation exposure?

Def^n	Common	SI units
Total Radiation exposure	Roentgen	Coloumb/KG
Absorbed radiation	RAD	GRAY. 100 RAD. Joule/kg
Biological equivalent effectiveness	REM	SIEVERT. =100 REM

How to measure Radioactivity

Common	SI
Curie	Becquerel
1g Radium /sec = 3.7×10^{10} d/s	1 d/sec

MOA of Radiation Injury = Free radicle DNA-mediated Damage

Most sensitive phase of cell cycle = G_2M

Least sensitive phase of cell cycle - Late S

Fetus most sensitive at - 6-15 weeks.

Max. permissible Dose - 0.5 RAD.

Cong. malformation is seen after - 5 RAD

* ↓ Blood cell most sensitive - Lymphocyte

* Tissue " " Bone marrow

GIT

Ioc for CHPS → USG.

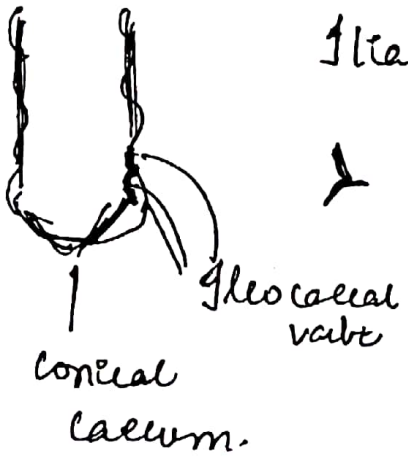
Ioc in pediatric Ac. Abdomen → USG.

INTESTINAL OBSTRUC"

Ioc → CECT.

Best X-Ray → X-Ray Abd. (supine)

BOWEL TB



Ileal strictures.
↳ String sign

Inverted umbrella sign or Fleischner sign

Asc colon shortens → pulled up caecum
↓
So, no more 90°

goose neck (obtuse angle)
ileum